

Timing and mode of delivery with advancing maternal age

Kate F Walker^{1*}, Jim G Thornton¹

¹Division of Child Health, Obstetrics and Gynaecology, University of Nottingham

Queen's Medical Centre, Derby Road, Nottingham, UK, NG7 2UH

kate.walker@nottingham.ac.uk

jim.thornton@nottingham.ac.uk

*Corresponding author

Abstract

In 2017 23% of all UK livebirths were to women aged over 35 years. Decisions around timing of delivery for such women must balance the risks of prolongation of the pregnancy and of iatrogenic harm from timed delivery. Women of advanced maternal age have a small age-related elevated risk of term stillbirth. Antenatal monitoring and route of delivery should not differ from those for younger women. Induction of labour at 39 weeks for such women does not appear to increase the risk of emergency caesarean section or to have any short term adverse effects on mother or baby. There have been no studies on the long-term effects of induction in this group. Nevertheless, it seems reasonable to offer women of advanced maternal age induction of labour at 39 weeks where resources are available to safely provide this.

Keywords

Stillbirth; advanced maternal age; caesarean; induction of labour; mode of delivery

Introduction

The average age at childbirth in the UK and other industrialised nations has been steadily increasing for the last 40 years. The reasons are complex and multifactorial and not always due to a conscious choice. Health care professionals must be sensitive to this and be aware that it may be due to a history of subfertility or pregnancy loss. Advanced maternal age is generally defined as women aged ≥ 35 years of age at the time of childbirth.

In 1996, the Office for National Statistics estimate that 12% of all livebirths were to women aged ≥ 35 years of age, by 2017 that had figure had risen to 23% in the UK. Women over 35 years are at higher risk of many pregnancy complications. In particular they have an increased risk of perinatal death and obstetric intervention. This influences the discussion to be had with women of advanced maternal age on both the timing and mode of delivery.

Clinical scenario

A 41 year old primiparous woman presents to your antenatal care at 10 weeks gestation in her first pregnancy. She has no significant medical history. Her pregnancy was spontaneously conceived. She is a non-smoker and has abstained from alcohol since

trying to conceive. She has no significant family history. She tells you that she would like to have an elective caesarean section and wishes to discuss both this and the timing of her delivery. She is not planning to have any more children in the future and feels that a caesarean section would be the safest option. The purpose of this article is to give you an overview of the relevant evidence base on timing and mode of delivery for women of advanced maternal age to be well prepared for this consultation.

Antenatal monitoring

The additional risks of stillbirth are insufficient on their own to recommend any additional routine monitoring. Screening for diabetes, blood pressure, proteinuria and fundal height measurement should be performed as for younger women.

Some authors advocate the use of customised charts, on the basis of parental ethnicity, height and weight, for fetal growth assessment but the evidence in support of this (1) has been criticised both on theoretical (2) and empirical (3, 4) grounds. Fetal growth standard charts such as the recently developed WHO (5) or Intergrowth21 (6) charts should be used in preference to locally derived reference charts.

Encouragement of awareness of changes in fetal movements is also popular but the evidence does not support it (7, 8).

Timing of delivery with advanced maternal age

Timing of delivery must be decided based on balancing the risks of prolongation of the pregnancy and risks of iatrogenic harm from early delivery both for the mother and the baby.

Baby risks

Antenatal

Choosing the correct denominator

The risk of perinatal death at gestational ages near term is often expressed as the number of all perinatal deaths at each week divided by the total number of births. However near term a baby cannot be stillborn once it has been delivered. Thus, the risk of remaining undelivered at each gestational age is better expressed as the risk per 100 babies undelivered at that time point, termed the perinatal risk index. Although the perinatal mortality rate is lowest at 41 weeks, the gestational age associated with the lowest cumulative risk of perinatal death is 38 weeks (9).

Risk of antepartum stillbirth: in all women

Stillbirth accounts for two thirds of perinatal deaths, and early neonatal deaths account for 33% (10). Intrapartum causes of stillbirth account for just 8.8% of all stillbirths. Excluding intrapartum causes, antepartum stillbirth accounts for 61% of all perinatal deaths (10). Twenty-eight percent of antepartum stillbirths are unexplained (10). Antepartum stillbirth is by far the most common cause of perinatal death at term (9). Six percent of stillbirths are due to congenital abnormalities and 35% of stillbirths occur at 37-42 weeks (the most common gestation for stillbirths to occur). Term, singleton, normally-formed, antepartum stillbirth (i.e. potentially preventable stillbirths) made up one third of all stillbirths [1039 (32%) out of 3286] in the UK in 2013.

Risk of antepartum stillbirth: in women of advanced maternal age

In a large retrospective study of over five million deliveries across the USA between 2001-2, Reddy *et al* examined the relationship between advanced maternal age and stillbirth (11).

The overall cumulative risk of antepartum stillbirth throughout gestation (from 20 to 41 completed weeks) for women of all ages was 6.5 per 1000 pregnancies. The cumulative risks of stillbirth for women younger than 35 years, 35-39 years and older than 40 years old, were 6.2, 7.9, and 12.8 respectively.

They found that while nulliparous and multiparous women had a similar increase in the risk of stillbirth with advancing maternal age, nulliparous women had a higher risk of stillbirth than multiparous women for all maternal age groups. Thus the risk of stillbirth at 37 weeks per 1000 ongoing pregnancies in women aged <35, 35-39 and 40+ was 3.72, 6.41 and 8.65 in nulliparous women and 1.29, 1.99 and 3.29 in multiparous women.

The largest increase in cumulative risk of stillbirth for women over 35 years of age starts at 39 weeks and peaks at 41 weeks. Women over 40 years old have a similar stillbirth risk at 39 weeks as women who are between 25 and 29 years old at 41 weeks, and once they pass 40 weeks gestation their risk of stillbirth exceeds that of all women < 40 years old at term [13]. To quantify that risk, the risk of stillbirth between 37-41 weeks for women aged 35-39 years old is 1 in 382 ongoing pregnancies (RR 1.32), and for women 40 years or older 1 in 267 ongoing pregnancies (RR 1.88). If we express this as a risk per 1000 ongoing pregnancies, 2.6 in 1000 for women 35-39, and 3.7 in 1000 for women aged 40+, then we can easily draw comparisons with the routine practice of offering induction of labour postdates, due to a 2-3 in 1000 risk of stillbirth for women of all ages [14].

It is a widely accepted practice in the UK to offer induction of labour for a pregnancy that continues beyond 41 weeks, termed a postdates pregnancy. This is because the rate of stillbirth increases six-fold from 0.35 per 1000 ongoing pregnancies at 37 weeks to 2.12 per 1000 ongoing pregnancies at 43 weeks [15]. The rate of neonatal (up to 28 days) and post neonatal (from 28 days – 1 year of age) mortality falls significantly with advancing gestation up until 41 weeks, when it plateaus and then increases with prolonged pregnancy. As such the overall risk of pregnancy loss (stillbirth plus death occurring up to the age of 1 year) increases 8 fold between 37 weeks and 43 weeks, justifying induction of labour at 41 weeks for all women.

Neonatal risks

Risk of respiratory morbidity

Most elective caesarean sections are performed at or after 39^{0/7} weeks' gestation (12). The timing of this is advised as the risk of neonatal respiratory morbidity falls with advancing gestation until 40^{0/7} weeks. The risk of respiratory morbidity in infants delivered by elective caesarean at 37^{0/7} weeks is four-fold higher than infants delivered at 40 weeks, three-fold higher compared to those delivered at 38 weeks and two-fold higher than those delivered at 39 weeks. The risk of developing neonatal respiratory symptoms for babies born by vaginal delivery falls from a probability of 0.07 at 37 weeks to 0.04 at 39 weeks and thereafter plateaus (13). Thus induction of labour at 39 weeks is the optimal balance between the risk of respiratory morbidity for the neonate and the risk of antepartum stillbirth for the fetus.

Hyperbilirubinaemia

There have been reports of an association between the use of oxytocin in labour and neonatal hyperbilirubinaemia (14). However, it is difficult to disentangle possible confounding by the earlier gestational age of babies who were delivered following induction of labour. Though Cochrane reviews of high versus low doses of oxytocin (15) and early versus late use (16) do not report jaundice, at least one trial showed no effect (17). Gestational age <38 weeks is a risk factor for the development of significant hyperbilirubinaemia (18). In an observational study comparing outcomes for low-risk singleton term newborns by gestational age, delivery <38 weeks was an independent risk

factor for the development of unexplained jaundice (OR=2.1, 95% CI 1.7–2.5) (19). The DAME trial, a randomised controlled trial of induction of labour at 37-38 weeks' gestation versus expectant management for suspected large for gestational age babies found higher rates of hyperbilirubinaemia requiring phototherapy in the induction group compared to the expectantly managed group (20).

Other neonatal outcomes

Gestational age <38 weeks is also an independent risk factor for the development of neonatal hypoglycemia (OR=2.5, 95% CI 1.5–4.3) (19). Perhaps unsurprisingly given the increased risk of respiratory morbidity, jaundice and hypoglycemia associated with delivery at 37 weeks' gestation, rates of admission to neonatal intensive care are also inversely proportional to delivery gestational age (21).

Observational studies have also suggested an increased risk of neonatal encephalopathy in children with cerebral palsy associated with delivery ≥ 41 weeks versus < 41 weeks (22).

Thus, the current data suggest that 39 weeks' gestation is the optimal gestational age for delivery for the baby, as it avoids the morbidity associated with early term birth and reduces the risk of antepartum stillbirth post term.

Maternal Risks

Risk of caesarean delivery: in all women

Observational data suggest that induction of labour results in an increased risk of caesarean delivery (23-25). For example, in England 2010-2011, caesarean rates were 11% among women who laboured spontaneously, and 23% among those who were induced. Rates of operative vaginal delivery followed similar trends (12 and 17% respectively) (26). However, there is significant confounding by delivery indication, as the reasons for induction (e.g. post-dates pregnancy, fetal growth restriction, reduced fetal movements) are also established risk factors for operative delivery. When observational studies choose the correct comparison group (i.e. induction of labour versus expectant management), studies have shown no difference in caesarean delivery rates at term (27), irrespective of whether delivery occurs during the early- or late- term time period.

Randomised trials of induction near term provide unbiased evidence. There have now been at least 38 such trials and at least three systematic reviews (28-30). These data show that induction of labour at term is not associated with an elevated rate of caesarean or instrumental delivery (Table 1). Despite the compelling evidence, this remains a contentious issue amongst health care professionals and women. Many of the trials included in the systematic reviews are for induction in postdates pregnancies or high risk groups (e.g. hypertensive disorders) rather than low risk women. The ARRIVE trial (6106 women), a randomised controlled trial of induction of labour at 39 weeks versus expectant management for low risk nulliparous women found that even in low risk women induction of labour was associated with a reduction in caesarean delivery was significantly lower in the induction group than in the expectant-management group (569 of 3059 in the induction group [19%] versus 674 of 3037 in the expectant management group [22%]; relative risk 0.84, 95% CI 0.76 to 0.93). Certainly within a US healthcare setting the question whether induction of labour increases caesarean births has been definitively answered.

Table 1: Rates of caesarean section and instrumental delivery in studies and systematic reviews of induction of labour at term

Study	Gestational age	Caesarean section		Instrumental delivery	
		OR/RR	95% CI	OR/RR	95% CI
Wood 2013	37-42	0.83	0.76, 0.92	1.09	0.98, 1.22
Saccone 2015	39-40	1.25	0.75, 2.08	1.22	0.83, 1.81
Stock 2012	37	1.02	0.89, 1.17	0.93	0.81, 1.06
	38	1.03	0.94, 1.13	0.95	0.87, 1.04
	39	1.08	1.00, 1.16	0.98	0.91, 1.05
	40	0.83	0.79, 0.88	0.85	0.82, 0.89
	41	0.66	0.63, 0.69	0.78	0.74, 0.81
Mishanina 2014	37 – 41	0.87	0.82–0.92	n/a	n/a

Risk of caesarean delivery: in women of advanced maternal age

The caesarean delivery rate for nulliparous women over 35 years in the United Kingdom is 38% and 50% in women over 40 years (31). In nulliparous women, the relationship between maternal age and delivery by emergency caesarean is linear (32).

Some obstetricians induce older pregnant women at the due date (40 weeks) (39% women aged 40-44, 58% women aged over 45), but of those who do not, one third are reluctant to offer it for fear of increasing the risk of caesarean despite believing it will improve perinatal outcomes (33).

We conducted a randomised, controlled trial of 619 primiparous women ≥ 35 years old (34). Women were randomly assigned to labour induction at 39⁺⁰ - 39⁺⁶ weeks' gestation or to expectant management. The primary outcome was caesarean delivery. In an intention-to-treat analysis, there were no significant between-group differences in the percentage of women who underwent a caesarean section (98 of 304 women in the induction group [32%] and 103 of 314 women in the expectant-management group [33%]; relative risk, 0.99; 95% confidence interval [CI], 0.87 to 1.14) or in the percentage of women who had a vaginal delivery with the use of forceps or vacuum (115 of 304 women [38%] and 104 of 314 women [33%], respectively; relative risk, 1.30; 95% CI, 0.96 to 1.77). There were no maternal or infant deaths and no significant between-group differences in the women's experience of childbirth or in the frequency of adverse maternal or neonatal outcomes. We performed an alongside economic evaluation of the intervention from a National Health Service (NHS) perspective and found that the intervention was associated with a mean cost saving of £263 and a small additional gain in QALYs (though this was not statistically significant), even without considering any possible QALY gains from stillbirth prevention. We concluded that a policy of induction of labour at 39 weeks for women of advanced maternal age would save the NHS money (35).

Mode of delivery with advanced maternal age

The choice about mode of delivery that exists is not elective caesarean vs. vaginal birth. It is elective caesarean vs. trial of vaginal birth, as the latter may or may not succeed. A planned trial of vaginal birth is accomplished either by induction of labour or expectant management (i.e. waiting until the spontaneous onset of labour or until the development of a medical problem that mandated induction). First, we will explore the risks of induction

of labour itself (not the method used) other than caesarean delivery (discussed already) in women with advanced maternal age.

Induction of labour

Fortunately most complications are uncommon. Complications to consider in a discussion about the risks of induction include: cord prolapse and uterine hyperstimulation. But it is also important to discuss labour duration/length of hospital stay and maternal pain

Cord prolapse

Umbilical cord prolapse complicates 1.25 – 2.1/1000 deliveries (36, 37). In one retrospective study of 57 cases over a 10-year period, cord prolapse occurred with amniotomy in 42% of cases (36). However, does amniotomy increase the risk of cord prolapse? A retrospective case-control study of 37 cases of intrapartum umbilical cord prolapse and 74 matched control patients with intact membranes found that the use of amniotomy in patients who had a cord prolapse was similar between groups (38). A larger retrospective case control study in which 80 cases of umbilical cord prolapse were matched with 800 controls, found that amniotomy was not associated with umbilical cord prolapse; in contrast, there was a nine-fold increased risk of umbilical cord prolapse associated with spontaneous rupture of membranes (39). Umbilical cord prolapse is associated with significant morbidity to both the mother and the fetus, as emergent caesarean delivery is indicated as soon as possible after detection.

Uterine hyperstimulation

Uterine hyperstimulation is generally defined as more than 5 contractions in 10 minutes or contractions lasting more than 2 minutes. This complication arises in approximately 1-5% of cases where pharmacological agents are used to induce labour (40), and may also occur in spontaneous labour. It may occur with or without fetal heart rate changes. During uterine contractions, blood flow to the intervillous space (where oxygen exchange between the mother and the fetus occurs) is interrupted (41). Between contractions, in the relaxation phase, blood flow – and thus oxygen exchange – is restored. If the interval between contractions is reduced, or if the duration of the contraction(s) increases, then a critical point may be reached where fetal hypoxemia ensues. Simpson *et al* found that uterine hyperstimulation was associated with significant fetal oxygen desaturation and non-reassuring fetal heart rate changes. It is important to note that there is no risk of uterine hyperstimulation with mechanical methods of induction.

Maternal pain

There is evidence that induced labour is more painful than spontaneous labour. United Kingdom data on analgesia in labour reveals that women who deliver vaginally who have an induced labour are over twice as likely to request epidural anesthesia as women in spontaneous labour (21% vs. 8%,(26)). One small study (n=61) by Capogna *et al* found that the minimum effective analgesic dosage of sufentanil (a synthetic opioid) given via an epidural for women with an induced labour was 1.3 times greater than in women with a spontaneous onset of labour (p = 0.0014),(42). In our randomised, controlled trial of 195 primiparous women ≥35 years old comparing labour induction at 39 weeks of gestation versus expectant management, we found no difference in epidural usage between the groups (105 of 304 women in the induction group [35%] and 90 of 314 women in the expectant management arm [29%], p = 0.11. There were no differences between the groups in overall childbirth experience which included questions about pain.

Labour Duration

It is difficult to perform meaningful comparisons of the duration of labour between induced and spontaneous labour even in randomised trials. Women undergoing induction of labour have a clear time of onset (e.g., the time of insertion of prostaglandin, a balloon catheter

or amniotomy). In contrast, the time of onset for women in spontaneous labour is difficult to define. In a large retrospective observational study of low-risk women comparing approximately 10,000 women who laboured spontaneously with 1000 women who underwent labour induction for no apparent medical indication, induction was not associated with a prolonged labour. However, induction was associated with a longer admission-to-delivery interval and the maternal total length of stay was 0.34 days longer with induction compared to spontaneous labour ($p = < 0.0001$) (23). Findings were similar in a retrospective study of 2681 low-risk multiparous women, where women who were induced had a significantly shorter labour than those who laboured spontaneously (99 minutes vs 161 minutes, $p = < 0.001$) (43).

Caesarean delivery

To avoid these complications of induction of labour should we offer delivery by elective caesarean section? In 2013, the National Institute for Health and Clinical Excellence introduced new guidance on maternal request for caesarean section stating that "if after discussion and offer of support, a vaginal birth is still not an acceptable option, offer a planned CS" (31). Rates of Caesarean section performed primarily for maternal request vary by country. In the United Kingdom in 2001, 7% of all Caesareans were elective for maternal request (32). Though there is a paucity of data in the literature to know whether these rates have recently increased, overall CS rates in the UK have remained stable (2012 25.5%, 2015 26.5%). It is imperative that the comparison groups are carefully examined when evaluating observational data on vaginal delivery vs. planned Caesarean. The best comparison is planned caesarean delivery versus planned vaginal delivery (i.e. an intention to treat approach). Some women in the planned vaginal delivery group will deliver by unplanned caesarean section.

Benefits to Caesarean delivery

Avoidance of perineal trauma

Women of advanced maternal age have an increased risk of major perineal trauma based on ultrasound detection of such injuries. In a secondary analysis of data from a randomised controlled trial (606 nulliparous women) of a device used to stretch the perineum to try to prevent major perineal trauma, the authors found that advancing maternal age was associated with an incremental risk of major pelvic floor trauma with an odds ratio of 1.064 for overall risk of injury for each increasing year of age past age 18 years ($p = 0.003$) (44). This study was performed as the previous contention was that an observed increased risk of obstetric anal sphincter injury in women of advanced maternal age in retrospective studies may simply be as a result of detection of injury sustained in previous deliveries as the studies included multiparous women (45).

An elective caesarean section avoids the risk of perineal trauma associated with vaginal delivery. Perineal trauma of varying degrees occurs in 85% of women who give birth vaginally in the United Kingdom. Obstetric anal sphincter injury, comprised of third and fourth degree tears, is diagnosed in 3% of primiparous women and 0.8% of multiparous women following a vaginal delivery, though its true incidence is likely to be 11% (33). One randomised study with clear unbiased data (the Twin Birth study) had no cases (0%) of obstetric anal sphincter injury in the planned CS group and four cases (0.3%) in the planned vaginal delivery group (34).

Reduction in urinary and faecal incontinence and pelvic organ prolapse

There is less certainty when it comes to the matter of long term urogynecological outcomes including urinary and faecal incontinence and pelvic organ prolapse (33). In the case of stress urinary incontinence, any protection offered by a planned caesarean section is reduced by: advancing age, multiple caesarean sections (no protection if ≥ 3), caesarean sections performed in labour and future vaginal births. Even women with all deliveries by Caesarean section are not "immune" to developing these complications. Vaginal delivery may lead to an impairment in anal function in two ways: obstetric anal sphincter injury and pudendal neuropathy. This latter mechanism may explain why although planned caesarean delivery has been shown to be protective against obstetric anal sphincter injury (35) it may not be completely protective against anal dysfunction. In a questionnaire study of 1336 women aged 40-60 years, there was no association between vaginal delivery (as opposed to Caesarean delivery) and self-reporting of symptoms of anal dysfunction (36).

The Term Breech Trial found lower rates of urinary incontinence at 3 months postpartum among women in the planned caesarean section group (36 of 798 women in the caesarean group [4.5%] and 58 out of 797 women in the planned vaginal delivery [7.3%]; RR 0.62; 95% CI 0.41-0.93) (37), but at 2 years postpartum, the rates of urinary incontinence were not significantly different between groups (81 of 457 women in the caesarean group [17.8%] and 100 of 460 women in the planned vaginal delivery [21.8%]; RR 0.81; 95% CI 0.63 – 1.06) (38). The Term Breech found no significant difference in self-reported rates of faecal or flatus incontinence between groups at three months or two years (37, 38). Thus, there is insufficient evidence to recommend a planned caesarean section to reduce the risk of stress urinary incontinence.

A large observational study looking at the risk factors for pelvic organ prolapse found that parity was the most significant independent risk factor and the risk increases with each successive baby (Figure 1) (39).

Though parity has a significant role in the risk of POP, is planned caesarean delivery protective? A large questionnaire study of over 4000 women measured self-reported pelvic organ prolapse, and found there was no significant difference in the rate of prolapse between nulliparous women and parous women who had delivered by Caesarean. However, the risk was increased in parous women who had delivered vaginally. When comparing parous women who had delivered by Caesarean versus parous women who had delivered vaginally, the aOR was 1.82 (CI 1.04–3.19). When comparing parous women who had delivered vaginally versus nulliparous women, the aOR was 3.21 (CI 1.96–5.26). The findings were similar in another large questionnaire study of 2000 women, where the OR increased with increasing numbers of vaginal births [caesarean only OR 1.6 (0.4-6.4), 1 vaginal birth OR 2.8 (1.1-7.2), 2 vaginal births OR 4.1 (1.8-9.5), 3 or more vaginal births OR 5.3 (2.3-12.5)]. From the observational data, there appears to be an association between vaginal delivery and self-reporting of pelvic organ prolapse.

Risks of caesarean delivery

Caesarean delivery constitutes major abdominal surgery and carries both short and long term risks.

Lilford et al explored the risks of maternal mortality associated with vaginal delivery, elective Caesarean and emergency caesarean excluding women with medical or life-threatening antenatal complications. They found that the risk of maternal mortality for Caesarean versus vaginal delivery was 5:1 and emergency Caesarean versus elective Caesarean was 1.5:1 (40). The main reason vaginal delivery was found to be safer than

Caesarean delivery is not the comparison between the first Caesarean section and first vaginal birth but the exponential increase in risks associated with subsequent Caesarean sections summarized with the phrase "the first cut is not the deepest". Given that women of advanced maternal age are less likely to have subsequent pregnancies than younger women, concerns about the risks of subsequent caesarean deliveries must surely be reduced.

A large, well designed case control study examined the risks of caesarean delivery in women of advanced maternal age (46). The authors looked at cases of intra or postpartum severe acute maternal morbidity that were not the result of a condition present before delivery versus cases without severe morbidity. The authors were careful to eliminate cases where existing morbidity may have been the justification for caesarean delivery and therefore lead to greater morbidity from the caesarean delivery and also to adjust for prior caesarean birth. They found that caesarean delivery was associated with an increased risk for severe acute maternal morbidity (adjusted OR 1.8, 95% CI 1.5–2.2). This association increased with maternal age and was particularly marked for women aged 35 years or older (adjusted OR 2.9, 95% CI 1.9–4.4). This increased risk was significant for emergency caesareans in women of all age groups and highest in women aged ≥ 35 yr (adjusted OR 4.1, 95% CI 2.4–6.9) and also significant for caesareans performed before labour in women aged 35 years or older (adjusted OR 5.1, 95% CI 2.3–11.0). The risks are not reported for nulliparous versus multiparous women.

Placenta praevia and the morbidly adherent placenta

The maternal and neonatal morbidity and mortality associated with placenta previa and placenta accrete are considerable. Rates of both condition are on the increase due to the rising caesarean section rate and rising maternal age. This is because the placenta is less likely to 'migrate' upwards with development of the lower uterine segment if there is a scar in it. Placenta previa is associated with an increased risk of major obstetric haemorrhage (≥ 1000 ml blood loss) OR 13.1 (95% CI 7.47-23.0) (41), massive obstetric haemorrhage (≥ 1500 ml blood loss) (21%) (42), need for blood transfusion, and need for peripartum hysterectomy (11%). The risks with placenta accreta are profound. Women with placenta accrete spectrum are at high risk for an indicated preterm delivery, which most commonly occurs by planned Caesarean hysterectomy, and is at risk for major or massive obstetric haemorrhage, urologic (bladder, ureteral) injury, and other complications. Risks of placenta accrete spectrum increase exponentially with the number of prior Caesarean sections, and are highest among women with multiple prior Caesarean deliveries and placenta previa.

Uterine scar dehiscence or rupture

Uterine rupture is associated with maternal and perinatal morbidity and mortality. A landmark observational study by Landon et al examined the maternal and perinatal outcomes of vaginal birth after Caesarean section versus elective repeat caesarean section and showed that the risk of uterine rupture associated with vaginal birth after one Caesarean section was 0.7%(43). Twelve babies whose mothers had a trial of vaginal birth developed hypoxic ischemic encephalopathy (0.08%) and of those 12 cases, seven were associated with uterine rupture. Thirty-five women (0.2%) had a hysterectomy (five cases were performed for irreparable rupture) and 3 women (0.02%) died (of which no cases were associated with uterine rupture). In a large observational study of 159 cases of uterine rupture in the United Kingdom from 2009-10, 2 women (1.3%) died and 18 perinatal deaths associated with uterine rupture occurred (12%) (44).

Antepartum stillbirth in subsequent pregnancy

There is an association between delivery by Caesarean section in the first pregnancy and unexplained antepartum stillbirth in the second pregnancy. Smith et al found that the risk

of unexplained antepartum stillbirth ≥ 39 weeks' gestation was 1.1 per 1000 women who had had a previous caesarean delivery versus 0.5 per 1000 women in those who had delivered vaginally (45). The authors postulate this association may be due to impaired uterine vasculature due to previous surgery, abnormal placentation and subsequent utero-placental dysfunction.

Summary (250 words)

In 2017 23% of all livebirths were to women of advanced maternal age (≥ 35 years). Decisions around timing of delivery for women of advanced maternal age must be a balance between risks of prolongation of the pregnancy and risks of iatrogenic harm from timed delivery. Women of advanced maternal age have a small age related elevated risk of term stillbirth. Induction of labour at 39 weeks for women of advanced maternal age does not increase the risk of emergency caesarean section and has no short term adverse effects for mother or baby. We would therefore advocate offering women of advanced maternal age induction of labour at 39 weeks where resources are available to safely offer this. Women of advanced maternal age may consider opting for a maternal request caesarean birth. Women of advanced maternal have a high background risk of caesarean delivery. Some of the risks of a trial of vaginal birth (perineal trauma; emergency caesarean birth) are elevated in women of advanced maternal age. However this must be balanced with the apparent increased risk of serious maternal morbidity as a result of caesarean birth both before and during labour. We would therefore not advocate offering women of advanced maternal age elective caesarean delivery, but should they request it, a detailed discussion using the information contained in this article should help them to balance the pros and cons of this option.

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Conflict of interest

The authors have no conflicts of interest to declare

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