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Evaluation of 'Advanced Intermittent Auscultation (AIA)', 'Intelligent Intermittent Auscultation' and 'NICE guidelines' proves AIA as most scientific and safe, avoiding serious risks from the latter two regimes.

Shashikant L Sholapurkar
Consultant Obstetrician and Gynaecologist, Royal United Hospital NHS Foundation Trust, Bath, UK

Abstract
Intermittent Auscultation (IA) of fetal heart rate (FHR) is widely practiced across the world and its scientific validity is important for perinatal safety. United Kingdom has led in the field of 'IA' and the guidelines by National Institute for Health and Care Excellence (NICE) are emulated world over. The NICE, the so-called 'Intelligent Intermittent Auscultation (IIA)' and 'Physiological IA' guidelines insist that the fetal heart sounds must be actually counted for one minute after contraction even when using a hand-held Doppler device (ignoring the digital display) and documented as a single number. On the other hand, a practical regime of 'Advanced Intermittent Auscultation (AIA)' disbands the (mistaken) ideological commitment to actually counting the fetal heart sounds and thereby amplifying the ability of midwives to detect the all-important temporal variations in FHR while using Doppler monitors. This article re-analyses an investigation disseminated by "NHS Resolution" in 2020 following many cases of severe birth asphyxia, which categorically assigned full accountability on the midwives for not following the NICE guidelines. The highest level of evidence of mathematical facts in real clinical cases proves that it was the unsafe methodology of NICE and IIA which was primarily and largely responsible for these severe fetal hypoxemic encephalopathies. The midwife was forced into serious errors because of the methodology by NICE and similar regimes. The article shows how even today the babies remain systemically exposed to serious harm and midwives to unfair blame and distress due to unscientific NICE, IIA and similar guidelines. When pointed out that a count over one minute gives a random average figure, not representative of anything when there has been an acceleration or deceleration; the IIA recommended an obsolete multiple-count method (adopted by K2MS™) which was practiced in 1980s before Doppler devices were available. This method is inaccurate / suboptimal, very difficult in first stage and almost impossible to practice in the second stage.
This article compares the common IA regimes and shows that the AIA is the most scientific, practical, pragmatic and safe regime. The serious patient safety concerns of NICE / IIA regimes and the scientific superiority of AIA have been raised with the regulatory bodies. The K2MS™ responded that they are guided by the 'popular' demand from midwifery interest-groups. In that sense the training online package like K2MS™ does not lead the education but follow demand by interest-groups. This contrasts with the trust by majority midwives that they are being guided and mandated by scientifically credible and safe guidelines. This article empowers midwives to critically analyse the scientific validity and practicality of the different modules by NICE, IIA and AIA, to protect their patients and themselves from harm. With that they should individually and in groups convey their opinions and concerns to the authorities like Royal College of Midwives (RCM) and K2MS™. The forward-looking AIA will enable the British midwifery practice to maintain its leadership in the field of IA and achieve future progress rather than remaining stuck in the previous century.

Keywords: Advanced Intermittent Auscultation, Intermittent Auscultation, Intelligent Intermittent Auscultation, Intrapartum fetal monitoring, Fetal asphyxia, Fetal heart rate decelerations, Intrapartum fetal surveillance, late decelerations, baseline variability

Introduction

Patient safety in the maternity services is on the highest agenda of the Department of Health (DOH) in UK. The most important component of this is perinatal morbidity and mortality. Serious intrapartum fetal hypoxia continues to be a rare but devastating complication for mothers and their families. Thus, the quality of intrapartum fetal monitoring is of paramount importance. It is long accepted that low risk labours (about 45% of all) will benefit from intermittent auscultation (IA) of fetal heart rate (FHR). In the UK, the investigatory bodies like the 'NHS (National Health Service) Resolution' and the Health Services Safety Investigations Body (HSSIB) continue to come across poor neonatal outcomes following IA despite the midwives following the guidelines by National Institute for Care Excellence (NICE) and other practiced regimes [1-7]. From 2018, the HSSIB has been responsible for the investigation of maternity cases that involve intrapartum stillbirth, early neonatal deaths or severe brain injury, conducting around 1,000 maternity investigations each year [8]. Hence, it is of critical importance that the Royal College of Midwives (RCM) and the Royal College of Obstetricians and Gynaecologists (RCOG) urgently explore improving the IA regime. The British midwives generally believe that they are mandated by the NICE and RCM guidelines with reasonably assessed scientific credibility and safety. However, recently the reputed training authority K2MS™ has admitted that their IA regime is based on demands received from a small midwifery interest-groups rather than proactively deciding on the most scientific or effective IA regime (repeated personal correspondence with K2MS™). Thus surprisingly, the K2MS™ guideline-makers are not leading but following midwives' opinion. The obstetricians

trained and practicing in UK (and many developed countries) have no detailed knowledge, interest or hands-on practical experience in IA but would sit on committees like NICE contributing to decisions on IA methodology. Disinterest and lack of ownership need to be guarded against. There is also a worry about decision-inertia that can affect committees and the regulatory bodies. Midwives need to be made aware that they are in the driving seat and thus in charge of making IA safer and making progress.

Most importantly, this article re-examines the investigation report by the 'NHS Resolution' stemming from many cases of severe fetal hypoxic injuries [9] and proves that the deficiencies of NICE, IIA and analogous guidelines [1-7] were primarily and largely responsible for these serious events and the midwives seem have been unfairly and wrongly held culpable. The openness, transparency and discussion within the profession seems critical and desirable because the 'NHS Resolution' report seems to leave the babies exposed to continued serious risk. This also has a world-wide relevance wherever similar guidance is followed. This article critically compares the current IA regimes viz. by NICE [1, 2], the two versions of the so called 'Intelligent Intermittent Auscultation (IIA) - also adopted by K2MS™ [3-5] and the "Advanced Intermittent Auscultation (AIA)" regime proposed over the last few years and formalised in 2022 [10, 11]. This comparison is summarised in Table 1. The analysis demonstrates that the way to prevent these serious harms is to adopt the AIA. All midwives in UK and many developed countries now almost exclusively use handheld Doppler monitors. Hence, the subject of this article is IA with Doppler units only. Other methods are described elsewhere [11, 12].

Brief history of different IA regimes

The fetal Pinard stethoscope was developed in 1880s and found wide use by 1950s [13]. The handheld Doppler devices were developed in 1960s but came into use only in late 1980s [13]. The IA regimes adopted from 1960s were based on logical thinking only. Different professional organisations recommended guidelines for IA starting in first decade of this century again based on expert consensus opinion only. A Cochrane systematic review [14] found only two trials of high methodological quality comparing IA to Cardiotocography (CTG). The regime in the dominant Dublin RCT (1981-83) constituted auscultation (counting) of FHR with a Pinard stethoscope for 1 minute after contraction (abnormal if FHR>160 or <100) [15]. There was however no specific mention of detection of decelerations in the study protocol. The auscultation was performed every 15 mins in the first stage and every 5 mins in the second stage of labour purely based on protocol. The conclusions from the Dublin trial cannot be applied unaltered to the IA regimes today because of major changes in labour management and accumulation of more knowledge about FHR changes from CTG. Rigidly following the practice of IA from 1960- 80s will prevent all future progress and continue to cause serious harm to babies as described next.

Serious fallacies in a review of cases of serious harm presented by the 'NHS Resolution'

Recently, we came across an article by the "NHS Resolution" wherein it took an extraordinary step to widely publish (on the world-wide-web) a serious incident review of a case of IA with severe fetal asphyxia in labour requiring head cooling and leading to grade 2 hypoxemic Ischemic encephalopathy (HIE) with high risk of cerebral palsy [9]. Their asserted aim was to "advice, resolve and learn" for the wider midwifery profession. It very squarely holds midwives solely responsible for serious intrapartum asphyxia in similar cases by failing to follow the NICE guidelines [1, 2] very strictly. This article critically analyses the investigation presented by the "NHS Resolution" with a goal to improve patient safety, prevent avoidable harm, learn lessons and exonerate midwives of unfair blame and culpability. The re-analysis presented proves that the (unscientific) methodology of NICE, IIA and similar international guidelines [1-3,7] seem primarily and very largely responsible for serious harm to babies in this and similar cases.

The "NHS Resolution" is an arm's-length body of the Department of Health and Social Care of UK [16]. It provides expertise to the NHS on resolving concerns and disputes fairly, sharing learning for improvement and preserving resources for patient care. It aims to provide practitioner performance advice: managing concerns raised about the performance of doctors, dentists, pharmacists; and in this case midwives [16]. It also claims to dictate the safety and learning: helping providers of NHS-care to understand their own claims-risk profiles to target safety activity and share learning across the health service nationwide [16], which it professes to have done in the field of IA for midwives and obstetricians, in an open and transparent manner, in this and similar cases [9]. It is understandable that the "NHS Resolution" would have based their investigation on the advice of the experts from NICE, RCOG and RCM or independent medicolegal experts. However, if their specialist advice can be shown to be very mistaken and unsafe, then the "NHS Resolution" should take objections to their experts and take these concerns to RCM and NICE as to why they are not adopting a far more scientific AIA [10, 11] in the interest of the patient safety which the 'NHS Resolution' champions.

The Maternity Serious Adverse Incident: The NHS Resolution describes the following case story as fictional but representing several real cases submitted to the 'NHS Resolution Early Notification scheme' [9]. Their stated purpose is to prevent similar serious incidents happening to patients, families and staff. We are also aware of many similar cases across the UK. In this case, a primigravida in low-risk labour was monitored with intermittent auscultation [IA] throughout her labour. The baby was born with severe metabolic acidosis, required head cooling and developed grade 2 HIE. The "NHS Resolution" is right in suggesting that the abnormal FHR changes would have been present for a few hours before delivery. The patient was pushing involuntarily for 40 minutes when intermittent auscultation continued to be performed every 15 minutes. However, when the full cervical dilatation was confirmed, the midwife attempted to perform IA every 5 minutes as per NICE guidelines [1, 2]; but she found it difficult like many midwives would. She was honest in documenting that she was able to perform IA at intervals between 4 and 10 minutes. After 90 minutes of active pushing in second stage, a CTG was started which showed a high baseline FHR of 160/min and recurrent deep variable decelerations. The

'NHS resolution' asserts that if the midwife had done auscultation without fail at least every 5 minutes according to the NICE guidelines (i.e. 18 times in 90 minutes); then that very act alone, by some virtue, would have detected the FHR abnormalities and prevented the adverse foetal outcome. However, this midwife did count the FHR for about 13 times in the 90 minutes of the second stage (once every seven minutes on average) but completely failed to detect the high baseline FHR as well as the deep decelerations after the contractions. Hence, the crucial question missed by the 'NHS Resolution' is why the midwife missed FHR abnormalities 13 times in 90 minutes and whether she followed wrong methodology; rather than why she did not repeat the same method for five more times. The "NHS Resolution" insists that the midwives must follow the mandatory and strict methodology recommended by NICE, IIA and Physiological IA guidelines [1-3,7] that the fetal heart tones must be counted for at least one minute after contraction and written down as a single number (representing baseline FHR). The NHS resolution has confirmed that the part of the one minute of auscultation constituted a deep deceleration and a part reached the high baseline of 160 per minute as revealed by the CTG before birth [9]. With the knowledge of that CTG FHR record, an application of basic numerical literacy reveals that a count performed over that full minute written as a single number would be well below 160/min, could be around 130-140/ min i.e., very much normal. Therefore, the midwife never had a chance to detect the high baseline of 160/min precisely and primarily because she was mandated to follow the (misconceived) NICE methodology. Similarly focusing on this irrelevant single number by counting over one minute mandated by NICE / IIA and similar international guidelines [1-3,7] meant that she would miss any decelerations as well. The NHS Resolution also blames the midwife for failing to detect the progressive rise in FHR baseline. Notwithstanding, the single number documented never represented the baseline, and would vary up and down, depending on the varying depth and duration of the deceleration within the minute of 'counting'. The fallacies of a single count and imprecision of multiple count are demonstrated in figures 1 and 2. The figure 1 clearly demonstrates that a single number generated by counting the FHR for 1 minute after the contraction would give a figure of about 140/min, completely missing the high baseline of 170/min as well as the deep late deceleration, as would have happened in the cases encountered by the NHS resolution. Thus, the NICE methodology of counting to generate a random irrelevant single number can be seen to fail or mislead the midwife at the most crucial times, which is when decelerations are present during part of the minute after contractions.

Of note, the midwife cannot count for a bit longer than the minute with full flexibility because she will need to do an additional cumbersome calculation (and get an irrelevant number anyway). According to NICE / IIA, the midwife was supposed to have 'subjectively heard' the decelerations [1-3 ,7], but that is not a reliable or technique/skill, nor a reasonable or dependable expectation, because she would have been struggling, distracted and exhausted to keep on counting to a high number of about 140 every 4 -10 minutes not to mention at least every 5 minutes required by NICE and similar regimes [1-3,7]. A second midwife could not have overcome these fundamental intrinsic NICE / IIA methodological fallacy of single meaningless misleading number. It is justifiable to expect more frequent auscultation during involuntary pushing. However, importantly the unsafe NICE / IIA methodology also explains why the midwife missed any FHR abnormalities before the second stage by IA performed every 15 minutes, whether the patient was involuntarily pushing or not. Moreover, during the second stage the sheer effort and exhaustion of actually counting up to 140 per minute after catching the end of a contraction at least every 5 minutes would leave the midwife little thinking-time or mental bandwidth to meaningfully interpret the FHR periodic changes. We have heard of cases, where NHS investigatory bodies have recommended IA every 5 minutes for up to 4 hours to include involuntary and active pushing stages. It would be far better to perform auscultation with a more practical, reliable, informative and scientific technique of the AIA [10-11] with additional major benefit of being far less effort-intensive. Unfortunately, the "NHS Resolution" unfairly places the entire blame on the midwife and unwittingly advises all midwives to practise the misconceived NICE / IIA methodology which has continued to put babies at risk. No wonder, many similar investigations in UK have subjected many midwives to undermining, psychological distress and professional disrespect.

A scietific article in 2015 specifically pointed out the serious flaws in the NICE and similar methodologies and presented clinical cases seriously harmed as a result [17]. There are larger number of cases where the midwives do manage to at least document the IA every 15 and 5 minutes, but the babies are born with severe birth asphyxia. When there is no CTG performed before birth, these cases are considered unexplained or unavoidable because 'appropriate' IA with NICE methodology was documented. But if CTGs were to be performed before birth then they are likely to show pathological FHR changes, missed by the IA NICE / IIA methodology like the case above [9]. These cases would not even come under the radar of 'NHS Resolution' but would be preventable with a more scientific 'AIA' methodology. The futility and harm of actually counting the foetal heart tones for one minute after contraction have been long reported [12, 17] and these publications have been repeatedly forwarded to NICE during and outside their national consultations and to UK regulatory bodies. Unfortunately, the lack of response may be because of decision-inertia. Moreover, it is important that patient safety, science and midwifery wellbeing should take precedence over medical politics and small select-group interests.

Practicality and need of performing IA at least every five minutes in second stage

The recommendations for IA frequency are purely consensus based and there is no high-quality evidence for these. Consensus involves critical reasoning. The recommendation for IA every 5 minutes in second stage comes from the protocol of the Dublin trial in early 1980s [15]. It cannot be concluded that this high frequency may have been rigorously followed during the trial. Moreover, actual counting was required because hand-held Doppler units were not available in clinical practice. If there are about 3 contractions every 10 minutes, then a midwife will

have to auscultate after every contraction to meet requirement of at least every 5 minutes. Are the NICE / IIA guidelines forcing midwives to document (for fear of censure) something that they are often unable to do? Consider that the NICE guidelines require actual counting for one minute to a laborious count of a high number of 120 -160 after each contraction sometimes for a few hours continuously. The midwife then has to document many different things, apply thinking and offer holistic care. Is that feasible? Truthfully, two midwives will be required during second stage, one midwife only doing IA. Moreover, the laborious actual counting will generate irrelevant numbers in the presence of the all-important decelerations, which are very likely to mislead both the midwives (figure 1). Furthermore, a question must be asked during consensus development as to what is going to happen to FHR within 5 minutes? IA is applied to low-risk labours and if the (scientifically performed) IA has been normal so far, then what will change within 5 minutes and what's wrong about 2-4 minutes later than 5 minutes? The pathological FHR pattern in the cases encountered by 'NHS Resolution' above did not start within the IA gaps of 4 to 9 minutes, but were present for a few hours. If the IA is required after each contraction or strictly every 5 minutes for fear of FHR becoming abnormal, then one should really be doing continuous electronic monitoring or CTG during the second stage. Of course, that is not the case because the likelihood of FHR suddenly becoming abnormal is miniscule in low-risk labours and furthermore if that abnormality could be picked 3 to 4 minutes later what is going to be the harm? Prolonged bradycardia would be very rare in low-risk labours and IA is not meant to pick it, otherwise CTG should be performed in all labours. More importantly, if the IA is to be done every 5 minutes, then it should not be necessary to actually count to about 140 and get a misleading number to be mistaken as baseline FHR. It would be far more scientific to observe the FHR display on the Doppler unit, as prescribed in the AIA which will be far more informative and reliable in detecting abnormal baseline as well as decelerations [10, 11].

Logistically, it has been reported to be challenging to meet the the current prescribed frequency of IA [18]. A prospective study reported that the protocol for IA was successfully completed in only 3% of cases [19]. The AIA protocol [10, 11] gives midwives the best chance of meeting the prescribed frequency of IA with additional thinking time, thus improving the patient safety.

Empirical scientific approach and consensus

The empirical approach is often equated to clinical trials, which seems a misconception. Two contrasting approaches to finding the truth developed during the enlightenment era viz., Rationalist (Descartes and Spinoza) versus Empiricist (Francis Bacon) schools of thought. Rationalists, impressed by methods in mathematics and geometry, believed that only pure reason (arguments based on definitions, axioms, propositions, corollaries, logical proofs etc.) can lead to truth, while our senses could deceive [20]. However, pure reasoning cannot discover truth in many instances. Etymologically, empirical means 'from experience'. An actual experiment (e.g. clinical trial or RCT) is a superior form 'experience'. However, an empirical approach consists of experiments as well as careful observations, judicious experience and judgement / opinion subjected to critical thinking (the most favoured Bayesian approach). Moreover, we know that the experiments are not always correct and conclusions from RCTs can be overturned or simply not believed. Evidence rarely provides a single, decisive, emancipatory break with error [20]. Empirical knowledge is never 100 percent certain [20]. In a soft science like medicine, good-quality evidence is lacking for majority of recommendations made in most clinical guidelines. Sir Austin Bradford-Hill who ushered the era of modern evidence-based medicine (EBM) by pioneering RCTs remarked, "Any belief that the controlled trial is the only way would mean not that the pendulum had swung too far, but that it had come right off its hook!" [21]. Due to many practical reasons, large good-quality RCTs in intrapartum fetal monitoring especially IA are unlikely to be forthcoming. Hence, during consensus development, all questions must be asked and reasonably answered as far as possible. Uncertainty should be acknowledged where present. Healthy scepticism is single most important pillar of scientific approach. Good science ultimately benefits patients. Science makes progress by independent thinking and is stymied by rigid adherence to old instructions/ideas.

Serious limitations of NICE, single-count IIA and multiple-count IIA

The discussion so far proves the unscientific nature and serious risk to the babies of the single count of fetal heart tones for a minute or more mandated by NICE (2014, 2022) and IIA (2017) [1-3], the latter also promoted by the Physiological IA by Edwin Chandraharan [7]. The IIA also (mistakenly) imposes unnecessary burden of detecting 'post-decelerations overshoots' and 'cycling' [7, 22] which is neither required nor feasible / practical. The misconceived obsession with 'actual counting' of NICE / IIA and some international guidelines [1-3, 7] stems from the following (wrong) reasons.

1. We must continue to count because the protocol of the Dublin RCT in 1980s included counting (before Doppler monitors).
2. Because we continue to use the term 'auscultation' from before 1960s, we must carry on the laborious counting irrespective of its major risks and ignore the progress in Doppler technology.
3. We must have high-quality RCTs before we can abandon the (outdated, inaccurate and risk-prone) counting techniques.

The statement above is a misconception. Improvements based on even a 'precautionary principle' are often necessary for patient safety [23]. Most importantly, the evidence presented in this article constitutes pure mathematical (numerical) facts directly observed from actual clinical cases, which is in fact a higher level of proof than clinical studies on patient cohorts.

4. The most prominent, flawed and lamentable misconception comes from a couple of London based obstetric consultants, who commented in a peer review report, "I was taught not to rely on the number on the Doppler device screen as the accuracy of this cannot be guaranteed. I discussed this with a few midwives this week, and none relied on the screen number alone as all had concerns about the accuracy of this". Unfortunately, midwives would be wary of disagreeing.

This is a serious ignorance because the clinical hand-held devices use the Doppler technology of the same accuracy as that used by the CTG machines. Exactly the same FHR numbers seen on the Doppler display screen are plotted on a CTG paper which is the common gold-standard accurate continuous record of FHR. Most importantly, a clinical trial published in a leading American Journal concluded, "The accuracy of the heartbeat monitor was excellent compared with cardiotocography, with mean difference of −0.3 bpm only and 95th centile difference between −1.6 (CI −2.0 to 1.3) and +1.0 (CI 0.7–1.4) bpm, with intra-class coefficient 0.99. The FHR was detected on all occasions" [24]. It would be impossible to confirm an exact match but these results are compatible with one.

The physiological IA guideline [7] states that there have been instances when the Doppler device has miscalculated the FHR rate, hence the numbers displayed on the device screen should not be relied upon. The Doppler device can transiently double the FHR when the contact is poor, but these instances are very rare. Most importantly, the same difficulty can occur very rarely during CTG recording and hence the midwives are used to detect and overcome it. Basic care is required while using any technology. However, such rare and surmountable difficulty should not lead to adopting actual counting to generate uniformly meaningless and misleading single FHR number with everpresent risks.

The NICE, IIA and similar guidelines [1-3, 7] seem imprecise and muddled as to how the decelerations with late timing will be picked up. They state that midwives should subjectively 'hear' any decelerations. If the NICE intends the midwives to guesstimate the pathological decelerations with late component solely by ballpark subjective hearing, then why count for one minute? Only to get a fallacious number which will miss even a high abnormal FHR baseline? In contrast, the midwives can actually see an accurate FHR number going up or down on the Doppler unit display as well as hear it. Importantly, they are not distracted and misled by irrelevant laborious counting. Of course, with NICE and IIA guidelines, it is a credit to the midwives that they will often fortuitously detect some FHR abnormalities or do more / better than the prescribed guidelines and save the day (despite the guidelines). However, the FHR abnormalities should be picked up reliably by design as in 'AIA' and not by chance [10, 11].

Because of the fallacies of a single count, in 1980s when handheld Doppler units were not available, the author practiced a compromise and laborious method of multiple (or fractional) count over intervals of 15 seconds for one minute [12]. The multiple-count method is still far less reliable than observing the FHR display on the Doppler unit (Figures 1 and 2). However, the IIA team adopted the multiple-count method and continued to mandate actual counting [4]. It requires very laborious and error-prone calculations to assess baseline FHR and any periodic variations. The 'multiple-count IIA' would be very challenging to perform every 15 minutes and would be completely impossible to perform every 5 minutes in second stage. There is no surprise that we found no maternity units in UK practicing the 'multiple-count IIA' following an on-line search and an audit. The K2MS™ [5] endorses and teaches 'multiple-count IIA' and concerns were taken up with K2MS™ in early 2023. Their formal reply was that 'multiple-count IIA' was demanded by some midwives. It is unfortunate that K2MS™ did not check if any units are practising it at all or whether it is possible to do at all every 5 minutes or grequently in the second stage. With availability of Doppler devices, the cumbersome and inaccurate "multiple-count" method is obsolete.

"Advanced Intermittent Auscultation (AIA)" regime

An "Advanced Intermittent Auscultation (AIA)" regime was formalized in 2022, after advocating its scientific principles and benefits for patients and midwives over many years, together with a training module accessible on-line via the ResearchGate platform [10, 11]. Its foundational reasoning, significant advances / advantages and safety have been described in detail in other publications [10, 11] and have been briefly summarised in Table 1. The AIA maximises the advantages of the Doppler device but these are realised only when actual counting is given up and the displayed FHR is carefully observed which is well within the skill-set of midwives. The AIA would have prevented the cases of serious fetal hypoxic damage in cases encountered by the 'NHS Resolution' described above, which were primarily caused by the single-count methodology of NICE contrary to the conclusions by the 'NHS Resolution'.

Conclusions

Birth asphyxia is a distressing adverse event for mothers and families with severe degrees leading permanent brain damage of the new-born. The Intermittent Auscultation (IA) methodology by the NICE [1, 2], IIA [3, 4] and Physiological IA [7] are severely constrained by reflex adherence to instructions from 1960-80s. The critical analysis presented regarding the 'advice, resolve and learn' alert for birth attendants publicized by the 'NHS Resolution' [9] shows the strongest direct evidence from clinical cases that the NICE, IIA and Physiological IA [1-4, 7] methodology of 'counting' is primarily and largely responsible for missing the pathological FHR abnormalities leading to severe birth asphyxia and that risk continues unmitigated. These risks are largely preventable by the scientific and forward-looking 'Advanced Intermittent Auscultation (AIA)' methodology which would also allow future progress and research [10, 11]. The NICE, RCM, RCOG and other international guideline-groups should adopt and assimilate 'AIA' without any further inertia or delay.

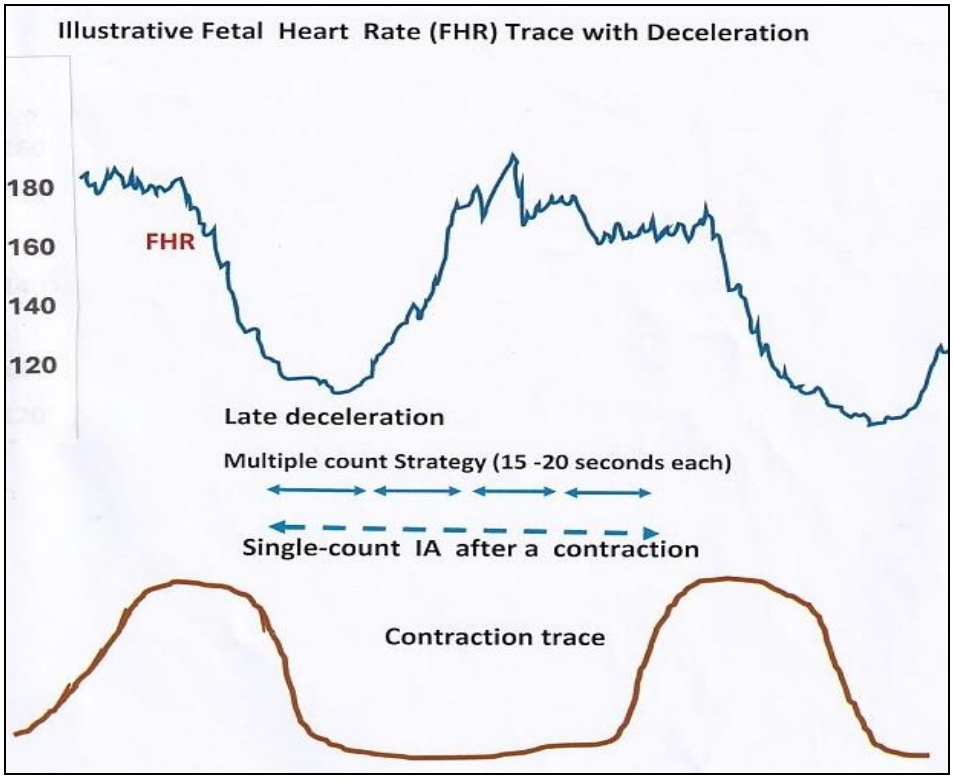

Fig 1: Schematic illustration of IA of FHR with late deceleration: Care is required not to mistake the recovering late deceleration as an acceleration. Actually counting the fetal heart tones over 1 minute with a Pinard stethoscope or Doppler-device will give a figure of about 140 bpm, not representative of the true baseline as well as the late deceleration [10, 12, 17]. Even the cumbersome 'multiple-count strategy' is less accurate than simply observing the numerical FHR display on the Doppler-device because the deceleration / acceleration is likely to spread across the two consecutive counting epochs of 15 - 20 seconds.

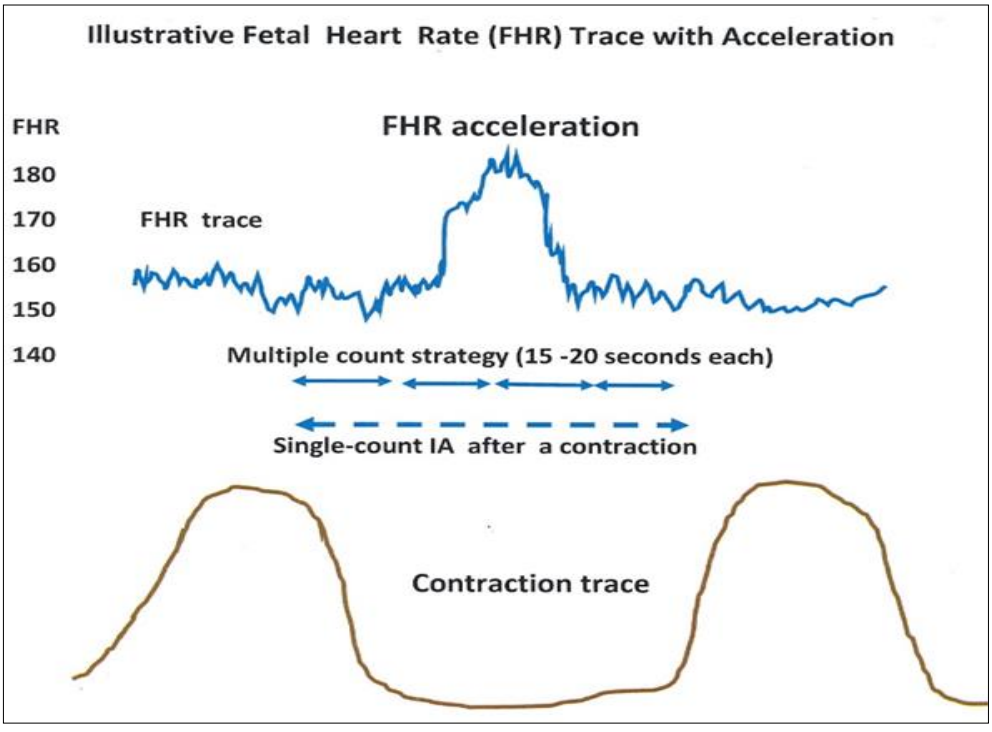

Fig 2: Schematic illustration of IA of FHR with acceleration: An acceleration can be inferred when a rise of FHR of 15 bpm or more is observed on Doppler-device display, preceded by a normal FHR baseline and return to it after the acceleration. This is not possible to detect reliably while actually counting fetal heart beats over a minute [10, 12, 17]. Moreover, the count over 1 minute spuriously gives an abnormally high figure (170 bpm) instead of a true baseline of 155 bpm.

Table 1: Critical comparison of different regimes of Intermittent Auscultation (IA)

IntermittentAauscultation (IA) by NICE, 2014, 2022, UK [1, 2]	**Intelligent Intermittent Auscultation (IIA): Primary single-count version [3] & Physiological Intrapartum Fetal Monitoring [7]**	**Intelligent Intermittent Auscultation (IIA): Modified multiple-count version (adopted by K2MS™ 2023) [4]**	**Advanced Intermittent Auscultation (AIA), 2022 [10, 11]**
Mandates actual count of fetal heart tones for one minute after contraction and writing it down as a single figure [1, 2].	Mandate 'actual coun't of fetal heart tones for 1 minute after contraction to be written down as a single figure. IIA mistakenly claimed that the rate over a "steady" period should be taken as baseline FHR even though that rate has not been counted separately [3].	Mandates actual counting of fetal heart tones separately during intervals of 15 seconds over one minute. This modification has been adopted after a demonstration [12] that a single count cannot represent FHR baseline and periodic variations. Remarkably, this weakness continues in IA by NICE and Physiologival IA [1, 2, 7].	**AIA recommends not to actually count the fetal heart tones but observe the FHR figure displayed on the Doppler device screen** for one minute at least (often very easily and flexibly longer) starting towards the end of a contraction. **The Doppler display shows the instantaneous concurrent FHR which is as accurate as the FHR plotted on the CTG.**
A single count over one minute gives an average over that minute which does not represent the baseline FHR nor any accelerations or decelerations when the FHR has varied over the auscultation period. Focus on this irrelevant single number ignoring the FHR displayed on Dopper device **firmly incorporates a systemic risk of missing crucial FHR abnormalities with potential for serious birth asphyxia.** Advocated "Listening" to any decelerations while concentrating on counting to about 140 is subjective, imprecise, unreliable and lacking judgement of depth/duration.		A very complex mental arithmetic of the four figures obtained over one minute is required giving average rate over each 15 second interval. Despite this, **only rough / imprecise judgement of FHR variations** can be obtained. Amplitude and duration of FHR variation cannot be judged. This method is cumbersome and impractical, hence British midwives are unwilling to adopt it.	**The AIA allows the best possible judgement of FHR baseline and FHR variations** even compared to the complex modified multiple-count version of the IIA. Any decelerations and accelerations are better detected with more reliable (if not perfect) observation of amplitude and duration, which is not at all possible by other methods involving actual counting of the fetal heart tones.
Make valuable flexible extension of auscultation duration almost impossible. Natural bar, inhibition or reluctance to extend auscultation. After counting to about 140 for a minute, one would almost always stop and not continue instantaneously. **A second different number generated would also contradict the guidelines** [1, 2, 3, 7].		Further complex calculation required if auscultation needs to be extended. Very strong natural inhibition, reluctance and difficulty to flexibly extend auscultation.	**AIA is very easy to extend** by continuing to observe the FHR display beyond one minute as required. When there is a late deceleration at the beginning of auscultation, the FHR baseline is much better judged shortly before the start of next contraction [17].
Counting repeatedly especially in the second stage is effort-intensive, tiring and **leaves little time for careful thinking and decision making**. Midwives have raised a concern that it simply cannot be done every 5 minutes in the second stage.		Impractically / excessively effort-intensive and tiring. **Impossible to perform every 5 minutes in the second stage.** Hence, British midwives have largely rejected it. Moreover, less accurate assessment of FHR variations compared to AIA.	**AIA is user-friendly, labour-saving and non-tiring as well as more accurate. Can be extended or repeated with ease. Allows more thinking time even during the auscultation.**
No method or amount of actual counting will give any idea about the (short-term) FHR baseline variability [12].		Even repeated multiple-count method cannot give any judgement of (short-term) baseline variability.	Although the assessment of (short-term) baseline variability is not essential in low-risk labors, the AIA opens up the possibility of subjective judgement of baseline variability and future research.
Actual counting becomes **an outdated technique** when the modern Doppler devices display an accurate concurrent FHR and its variations, important for safe fetal monitoring. Furthermore, all counting-based regimes would hinder future progress of IA.			AIA utilises full potential of the modern Doppler devices which is only possible when actual counting is consigned to the past. **The forward-looking AIA opens opportunities for future progress.**
Mandate a rigid approach to frequency and duration of auscultation, largely continuation of the past.			AIA adopts the most scientific broad empirical Bayesian approach incorporating knowledge from CTG [10]. AIA will allow further optimisation the regime using broad consensus to **improve practical performance and efficiency of IA and therby neonatal outcomes.**

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