Deceleration Area and Deceleration Capacity: Promising predictors of fetal acidaemia in human labour? Visual versus computerised cardiotocography

Shashikant Sholapurkar[1]

[1]Royal United Hospital NHS Trust

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Letter to the Editor, BJOG

Title:Deceleration Area and Deceleration Capacity: Promising predictors of fetal acidaemia in human labour? Visual versus computerised cardiotocography

Re: *Georgieva A, Lear CA, Westgate JA, Kasai M, Miyagi E, Ikeda T, Gunn AJ, Bennet L. Deceleration area and capacity during labour-like umbilical cord occlusions identify evolving hypotension: a controlled study in fetal sheep. BJOG 2021; https://doi.org/10.1111/1471-0528.16638.*

Author: Mr. Shashikant L SHOLAPURKAR

MD, DNB, MRCOG

Dept of Obstetrics & Gynaecology,

Royal United Hospital, Bath, BA1 3NG, UK

Email:s.sholapurkar@nhs.net; s.sholapurkar172@gmail.com; Tel: 07906620662

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Corresponding Author: Mr. Shashikant L SHOLAPURKAR

MD, DNB, MRCOG

Dept of Obstetrics & Gynaecology,

Royal United Hospital, Bath, BA1 3NG, UK

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Dear Editor,

It is intuitive to birth-attendants that the bigger and more frequent fetal heart rate (FHR) decelerations over a longer period (i.e. bigger cumulative deceleration area - DA) means increasing chance of fetal acidaemia/hypotension/hypoxaemic injury. The excellent animal study by Geogieva et al [1] confirms this expected correlation. However, obstetricians need to place this in the context of information already available from well-designed studies in human labour examining DA.[2,3] These studies show that the degree of correlation (even statistically significant) of DA to neonatal outcomes does not translate into clinically useful positive/negative predictive values (PPV/NPV). There are multiple unresolved logistical difficulties in addition.[2,3] The quoted[1] study by Cahill et al mistakenly states that their 'DA cut-off' requires five caesareans to prevent one case of acidaemia; because with its PPV of 4%, the correct calculation is 25 to one. Another analogous computer-derived parameter the "deceleration capacity (DC)" measures no capacity, hence somewhat a misnomer. One large cohort study of DC on 22,000 women lacked statistically-significant improved acidaemia detection and crucially the important receiver-operating-characteristic (ROC) curves were missing.[1] Another cohort study on 11,980 women showed the area under curve (AUC) for DC to be 0.66.4 This AUC reveals that if we want to detect 90%, 80% or 50% of acidaemic babies, the same deceleration capacity (DC) was shared by 80%, 60%, 25% of normal babies respectively, making DC disappointing for clinical application.[4] Similarly, The AUCs for deceleration area (DA) in human studies are very comparable and wanting.[2,3]

A lesson from wider experience in artificial intelligence (AI) implies that a constricted-single-parameter approach (e.g. DC/DA) may be insufficient for the complex task of intrapartum fetal monitoring. Computers have been beating chess-grandmasters for 25 years; because chess offers a "kind learning environment" with fixed rules, patterns repeating exactingly, feedback extremely accurate and very rapid. In the "unkind learning environments" devoid of rigid rules, singular domains and reams of perfect historical data; the AI and machine learning have been disastrous. Cardiotocography (CTG) requires integration of multiple FHR parameters with mother-fetus-labour-condition permutations. Intervention changes outcomes; hence the feedback can be inaccurate/unreliable. Human cognition assimilates these paradoxes. The greatest human strength is the exact opposite of narrow specialisation of AI. It is the ability to integrate broadly.

Research in computerised non-visual parameters like DA or DC like the current study[1] is important but alongside the visual CTG interpretation which seems indispensable in the foreseeable future. Computerised interpretation should emulate the visual pattern-recognition and then supplement it with new parameters when proven. A concept/philosophy is presented that all FHR decelerations are due to hypoxaemia.[1] It has been suggested that chemoreflex is an indefatigable guardian of hypoxaemic fetus and hypoxaemia per se does not matter.[5] An argument is proposed that the classification of decelerations into early/variable/late is irrelevant (red herring), hence the deceleration area (overriding the former classification) is the future.[5] Clinical experience so far seems different.[2,3] DA and DC consider all FHR decelerations to be the same (and hypoxaemic?). Given the complexities/setbacks in research on intrapartum monitoring, it seems an ambitious challenge to compute clinically useful thresholds of DA/DC in several different mother-fetus-labour scenarios. Studies on retrospective "Big-data" particularly suffer from confounding factors, importantly cord-gases available on a skewed smaller subgroup. It seems premature to relinquish to computerisation/DA/DC. Hence, obstetricians need to preserve and improve the scientific visual CTG pattern-recognition given the limitations, changeability and "back-box" nature of AI.

Statement of interest: The author has no conflict of interest to declare. Comments on limitations of AI are acknowledged to David Epstein's 2019 book "Range".

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