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INVITED REVIEW ARTICLE

Can We Deliver Better?

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Abstract Human childbirth has been described as an "obstetrical dilemma". Evolution favours enlargement of the foetal brain, whilst bipedal locomotion demands a reduction in pelvic breadth for improvements in biomechanical efficiency. The result of this conflict is a human pelvis incongruous with the dynamics of childbirth. Acute genital distortion at delivery can inflict lasting damage to female pelvic function. Pelvic organ prolapse, urinary, faecal incontinence and sexual dysfunction are long-term sequelae rarely discussed at antenatal care, impacting upon the expectant mother's ability to make an informed decision. The alternative option is the elective caesarean section, an abdominal incision bypassing the maladies of a vaginal delivery, although not without complications of its own. Childbirth remains an emotive event where evidence-

based medicine can be disempowered, and the rising trend to "normalise" birth can disrupt care of the woman. This needs to be maintained in a healthy balance to best provide competent and safe care for women.

Keywords Obstetrics · Childbirth · Pelvic floor · Anal sphincter · Trauma

Evolution of Human Childbirth

The human pelvis is a remarkable structure that has played a pivotal role in modern bipedalism. The shape of the pelvis has evolved over time to its current morphology and is critical to the ability to walk efficiently in an upright position with a minimal load or risk of injury [1].

The sacrum forms the posterior boundary of the pelvis and causes the pelvic inlet to be wider in the lateral diameter than in the anteroposterior diameter or true conjugate. The sagittal curvature of the sacrum is, however, responsible for the wider anteroposterior diameters at the mid-plane and the outlet of the pelvis.

Given a relatively large human foetal head, vis-a-vis other primates, the dimensions of which closely match maternal pelvic dimensions, a mechanically difficult and unique rotational pattern [2] of birth ensues with the infant often delivering in an occipito-anterior position. This rotation is imperative to allow the widest foetal dimensions to align with and traverse the maternal passage.

Self-assisted birth is the norm in non-human primates [3]—they tend to deliver their infants in an occipito-posterior position that allows mothers to guide the foetus through their birth canal, keep the cord from wrapping around the neck and to suck mucus from the nose to help the infant breathe.

Human mothers deliver in a fundamentally different and harder way, relying primarily on assistance for the delivery of their infants. Human birth has, thus, been described as an "obstetrical dilemma" [4] representing the conflicting forces of natural selection, in between the need to increase the size of the foetal brain (that would necessitate a larger birth canal) versus that of the need to decrease the overall breadth of the pelvis for locomotor efficiency.

The Demise of Pelvimetry?

The mid-1900s saw a dramatic change in obstetric practice [5]—the advent of diagnostic ultrasound led to a marked reduction in the number of X-ray examinations performed on antenatal women. This occurred from not just an increasing awareness of foetal and maternal irradiation risks but also a decline, in the western world, of the frequency of bony pelvic deformities secondary to nutritional deficiencies, that were thought to lead to a "contracted" pelvis.

Clinical pelvimetry has a substantially reduced role in current obstetric practice—partly because diagnostic ultrasounds cannot measure bony pelvic measurements, but also on account of conventional logic that emphasises a thorough clinical examination and trial of labour as better indicators of pelvic capacity. The argument against has been reinforced by multiple studies showing that evidence is not sufficient to support the use of X-ray pelvimetry [6].

A more recent study [7], however, that looked at postnatal women delivered by C-section for protracted labour, found significantly narrower pelvic outlets in these women—information that would not only be critical in determining the route of delivery in future pregnancies, but also to help provide answers to mothers who have been through a potentially traumatic labour and emergency C-section.

A universal labour-based determination of pelvic capacity for women fails to take into account racial and ethnic differences in women. MRI pelvimetry has now been shown to detect differences in the architecture of the bony pelvis in different ethnic groups with likely implications of this variation in anatomy on potential obstetric outcomes and on the incidence of pelvic floor disorders. These studies have hypothesised anatomical variations as potential causation for race-based differences in patterns of pelvic floor disorders.

Race has also been noted as a risk factor for perineal lacerations. An Australian study found a strong association between Asian ethnicity and severe perineal trauma [8]. However, race-based studies often do not account specifically for Indian ethnicity alone, which has been shown to be at a much greater risk of perineal laceration [9]—data is prone to potentially erroneous self-reporting by patients and to dilution by categorisation under a broader Asian population [10].

The Politics of Childbirth

In the last few decades, the western obstetric milieu has seen a concerted effort in favour of 'natural' childbirth by midwives. There is a strong cultural drive for 'birthing mothers' to resist and decline some or all medical intervention under the guise of 'normality' and 'empowerment'. It is argued that a 'medicalised' or 'pathologised' philosophy around childbirth has led to 'steady erosion of maternal choice, control and satisfaction in relation to many aspects of pregnancy and labour' [11].

The media and the internet have been influential in this artificial construct of 'natural' birthing which often veers to

the extreme 'valourisation' of mothers who avoid intervention and seek to disparage and attach 'stigma' to those who choose medical intervention [12].

This construct unfortunately ignores the record of the medical profession in achieving historically low mortality and morbidity rates [13] with interventions used in modern obstetric practice.

Modern medicine as we practise it, distinguishes doctors from patients—midwifery has blurred that distinction between patient and carer, under the construct of feminism and created a veneer of advocacy for women. This line of thought needs to be challenged, and the only way it can be corrected is by truly embracing woman-centred care in the truest sense of the word.

Informed Consent

Informed consent is a central tenet of modern medicine—it is a right of every pregnant woman to access unbiased, evidence-based, accurate information to help determine her choice for a particular course of management.

The notion of the freedom to choose, as is often sold to women, as being complete and absolute, is only partly true in that they do not make these choices in a vacuum completely free of the environment they live in. This choice or autonomy, in itself, is subject to various confounders—peer pressure, the advent of technology in medicine [14], the impact of media on perceptions around childbirth, etc. Articles [15] rue the impact of this choice and its contribution to women choosing to unreservedly deliver electively by C-sections.

The debate on the rising rates of intervention, artificial indices or targets for natural births or bureaucracy-driven guidelines should not be allowed to impact the conversation between doctor and patient. Health professionals should not refuse to comply with reasonable, well-informed requests made by adult women in charge of their own body. The broad legal opinion across most jurisdictions supports the position taken by women in making decisions that impact their body.

Pelvic Floor Dysfunction

Vaginal childbirth is likely to play the most significant role in the causation of pelvic floor dysfunction [16] that presents with symptoms of urinary incontinence, faecal incontinence and pelvic organ prolapse.

The mechanisms of trauma in childbirth are manifest—they may affect the pudendal nerve or its branches, the anal sphincter, the puborectalis–pubococcygeus complex and/or pelvic fascial structures [17].

Vaginal birth has a significant negative impact on the pudendal nerve [18], and the resultant deterioration in nervous function is usually associated with the length of second stage of labour rather than mode of delivery.

The pubococcygeus–puborectalis muscle complex is a v-shaped sling running in between the pelvic sidewalls and posteriorly around the anorectal junction. The levator hiatus, normally measuring 6–36 cm^2 in a nulliparous woman, between the arms of the V, forms the largest hernial portal in the human body and contains the urethra anteriorly, the vagina centrally and the anorectum posteriorly. An average foetal head in the plane of minimal diameters measures 70–100 cm^2—this implies a marked degree of acute genital distortion [19] noted at crowning that is quite likely to cause sustained pelvic muscular damage in a larger number of women than currently identified.

Forceps use is a major risk factor leading to both anal sphincter damage and levator avulsion [20]—a concept first described in 1938, that reports a rent in the muscle at its insertion to the pubis. This usually occurs at crowning but is often not picked up clinically unless made obvious by a large lateral wall vaginal tear. These tears are best diagnosed by tomographic ultrasound [21] and represent a much greater risk of prolapse and recurrent prolapse to the patients.

Levator avulsion enlarges the levator hiatus, reduces pelvic floor function and results in a markedly increased risk of prolapse that may be difficult to treat by conventional means as avulsion is a strong risk factor for recurrence.

Startling new data based on differing trends in rates of forceps usage in various countries suggest a clear link between forceps deliveries and major pelvic floor damage. The experience in Denmark [22] suggests a direct proportionality of reduction in forceps, a trend that began in the 1970s, being mirrored by a nearly 30% reduction in the lifetime risk of surgery for pelvic organ prolapse. On the other end of the spectrum lies the UK [23], where a revival in forceps deliveries with a near doubling of rates in the last decade has resulted in, by estimates, over a 100,000 additional major levator and anal sphincter tears.

In an age when the total fertility rate is rapidly declining globally [24] and as increasing evidence around childbirth and pelvic floor dysfunction emerges, a fundamental question arises. Should the primary endpoint of a reduction in the Caesarean section rate become a Key Performance Index for Obstetric Services or should we aim for a prophylactic Caesarean approach in women most at risk of delivery-related pelvic floor trauma?

Predicting Pelvic Floor Trauma

At the 38th Annual International Urogynecological Association (IUGA) meeting in Dublin, Ireland, in 2013, it was discussed as to the ability of a clinician to offer patients evidence-based antenatal advice for pelvic floor dysfunction from childbirth.

The factors that could help derive such a predictive score were grouped under the acronym UR-CHOICE. This tool would ideally be used at 37 weeks' gestation to counsel women, with a low score being directly proportional to a lower risk of pelvic floor dysfunction. It is also meant to take into account the desire for total number of children to better counsel women about future risks of multiple Caesarean sections too.

U Urinary incontinence before pregnancy
R Race/ethnicity
C Child bearing started at what age?
H Height (mother's height)
O Overweight (weight of mother, BMI)
I Inheritance (family history)
C Children (number of children desired)
E Estimated foetal weight

"Hands On" the Perineum

Standard practice has long advocated perineal support at crowning—this involves pressing the baby's head to slow down delivery and simultaneously supporting the perineum with the other hand using the extended thumb and index fingers with the flexed middle finger taking a grip on the baby's chin; once most of the head is out, the perineal ring is pushed under the baby's chin. This has been thought to facilitate spontaneous vaginal delivery, whilst reducing the risk of perineal trauma.

This practice has, however, had a reversal of fortunes with current guidelines [25] suggesting "hands on" or the "hands off" as both being appropriate to facilitate spontaneous vaginal delivery. This advice has been based on data [26] disputed as having been prone to reporting bias and as having conflated the purported benefits of the "hands off" cohort.

Response to the clinical question, of the impact of this practice on anal sphincter injury, has been obfuscated by a dogma-led approach against intervention, that avoids perineal support even in women at high risk of obstetric anal sphincter injuries.

Studies continue to show that, even after excluding high-risk deliveries, there is a significantly lower risk of anal sphincter injuries associated with manual "hands on" support of the perineum at crowning [27].

Although there are many factors during labour and delivery influencing final outcome with regard to anal sphincter injury damage, the "hands-off" technique could be a contributing factor that needs to be addressed with aggressive re-education and a significant cultural change in obstetric workplace practices.

The Protective Episiotomy

As the single most common surgical procedure in obstetrics, routine episiotomy in nulliparous women was standard management for over two centuries. Relieving pressure on the central posterior perineum by an episiotomy and/or controlled delivery of the head is an important consideration in reducing the risk of obstetric anal sphincter injury.

Observational studies in the past few decades have failed to support a protective benefit of episiotomies in the prevention of pelvic floor relaxation and urinary or faecal incontinence [28]. Recent studies comparing routine use versus a restrictive episiotomy policy has shown less posterior perineal trauma, less suturing but more anterior perineal trauma with a restrictive episiotomy practice [29].

Crowning causes acute perineal distension [30] of up to 170% in the transverse direction and 40% in the vertical direction, leading to significant differences (15°–30°) between episiotomy incision angles and suture angles. Episiotomies with suture angles $<30°$ or $>60°$ are associated with an increased risk of anal sphincter injury. Suture angles of 40°–60° are in the safe zone. This estimation is an important skill to acquire as clinicians are poor at correctly estimating episiotomy angles on paper and in patients.

Conclusion

A growing body of evidence has shown association between childbirth and pelvic floor dysfunction such as urinary incontinence, pelvic organ prolapses, and faecal incontinence. These outcomes can significantly impact the woman's quality of life not to mention future morbidity from unavoidable surgical interventions. Needless to say they carry a huge medicolegal burden for the Obstetrician too.

The contemporary environment encourages a mythical quest for increasing vaginal delivery rates through the development of a generation [20] of guidelines and clinical recommendations that have a singular focus on reducing intervention. This often brings patient expectations, practitioner concerns and clinical outcomes into direct confrontation which is not in the labouring woman's best interests often exposing her to adverse short, medium and long-term outcomes.

Constant evaluation of obstetric practice should be the imperative, guided by the best evidence available and a

focus on prevention of unintended harm through a more nuanced approach to intervention.

Compliance with Ethical Standards

Conflict of interest Ajay Rane, Jay Iyer, Harsha Ananthram and Thomas Currie declare that they have no conflict of interest.

Human and Animals Rights Ajay Rane, Jay Iyer, Harsha Ananthram and Thomas Currie declare that no human research participants were involved in composing this invited review article. Ajay Rane, Jay Iyer, Harsha Ananthram and Thomas Currie declare that no animals were involved in composing this invited review article.

Informed Consent Ajay Rane, Jay Iyer, Harsha Ananthram and Thomas Currie declare that informed consent was not required for this invited review article as no human research participants were involved.

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