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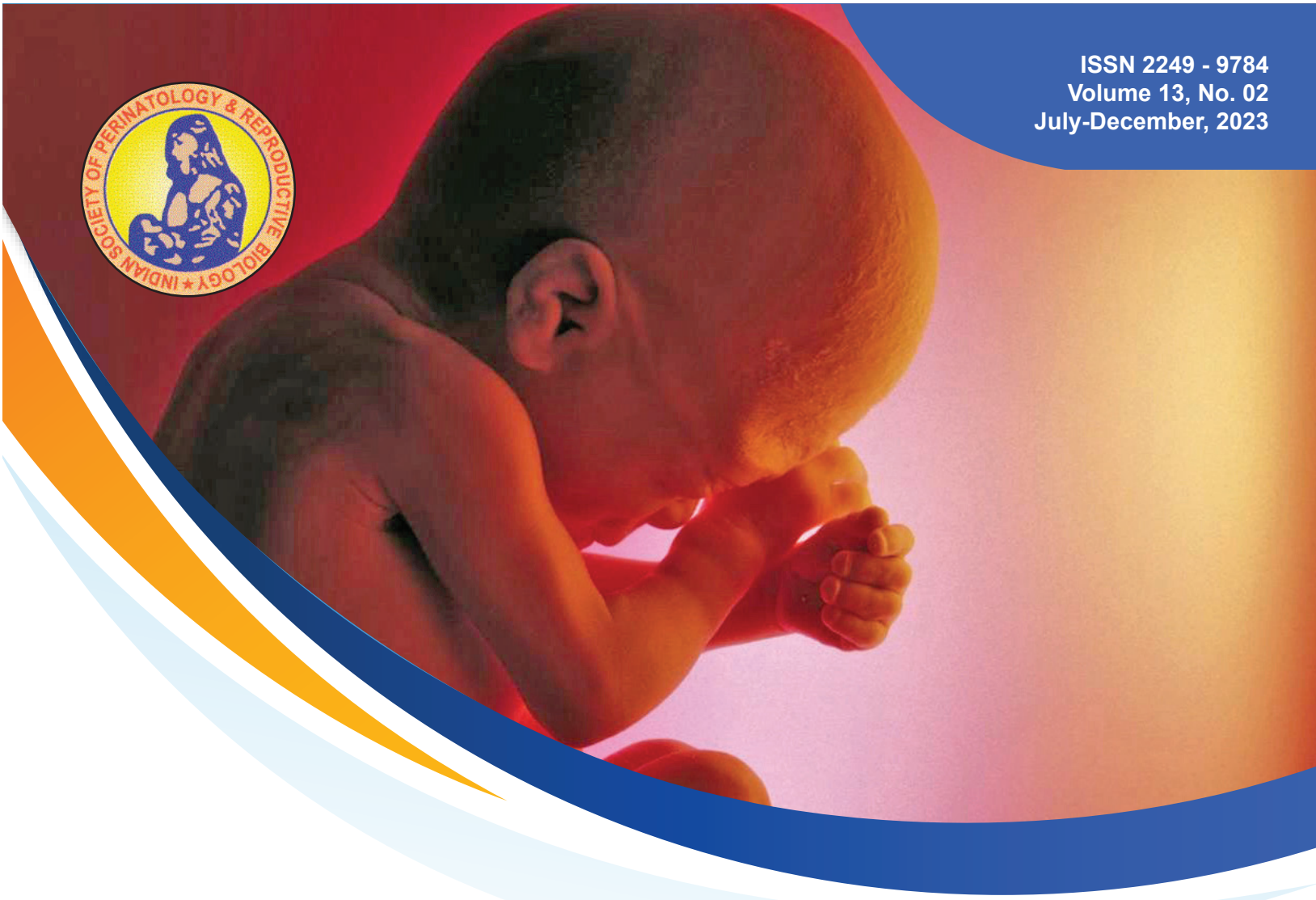

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Editor's Choice

Artificial Intelligence in Obstetrics & Gynaecology

Professor (Dr) Ramprasad Dey

Introduction:

Artificial intelligence (AI) is the simulation of human intelligence in machines that are programmed to think and learn like humans. AI has the potential to revolutionise the way that healthcare professionals diagnose, treat, and manage conditions affecting all organs including the female reproductive system. AI has been applied to the field of medicine for several decades. One of the earliest examples of AI was the development of computer-aided diagnostic systems for ultrasound images in the 1970s and 1980s. These systems were designed to assist radiologists in identifying fetal anomalies and other conditions. In recent years, there has been a renewed interest in the use of AI in obstetrics and gynaecology, driven by advances in machine learning (ML) and the availability of large amounts of data. One of the primary areas in which AI and ML are being used in obstetrics and gynaecology is in the analysis of imaging data, such as ultrasound and magnetic resonance imaging. AI algorithms can be trained to automatically identify and classify different structures in the images, such as the placenta or fetal organs, with high accuracy.

Artificial intelligence (AI) is a type of digital computer system that parallels the way the human brain processes information. AI is organised in a similar way that neurons in the brain are arranged, with their multiple neural nodes, and so are referred to as neural networks. These networks attain the most probable outcomes as the neurons are associated with numerous synapses that aid in transferring the data among the neurons back and forth.[1] Assembling these manifold connections helps the computers imitate cognitive functions such as finding the appropriate solution to a problem, reasoning, etc. This complex algorithm AI software is being utilized in medicine to analyse large amounts of data, which can assist in disease prevention, diagnosing, and monitoring patients.

AI & Personalised Medicine:

Modern medicine has shifted from developing treatments after the fact, to preventing, personalising and delivering precision care. This requires vast amounts of data to increase available knowledge on disease processes. AI can play an important role in the development of personalized medicines at all relevant phases of the clinical development and implementation of new personalized health products, from finding appropriate intervention targets to testing them for their utility. Four emerging complementary themes in biomedical science are personalized medicine, emerging data-intensive technologies, big data and information technologies (IT) infrastructure and artificial intelligence. AI is required in all phases of the development of personalized medicine.[2] The ability of AI to advance personalized medicine will depend critically on the refinement of relevant assays and ways of storing, aggregating, accessing and ultimately integrating the data they produce. AI has been declared as the primary tool to synthesise data to achieve the vision of personalised medicine.

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Applications of AI in Obstetrics:

Obstetrics and Gynaecology are the debatable specialties which account for indemnity payments due to negligence claims. Besides litigation costs, socioeconomic consequences on a long-term basis due to medical errors are also detrimental. Hypoxia-induced encephalopathy has become the most common confrontational event due to intrapartum fetal misinterpretation, which can be partially preventable. The conventional methodologies are considered inadequate in offering treatment stratification on an individualized basis with various limitations. In obstetrics, artificial intelligence is being actively applied and integrated into our medical system such as for obstetric diagnostic purposes, in fetal cardiotocography, ultrasonography, magnetic resonance imaging, aiding in the determination of pregnancy complications and preterm labour etc. Similarly, infertility treatment too has remained a major concern with conventional approaches.

Antenatal Ultrasound: USG is a safe, non-invasive checkup method for prenatal diagnosis. Despite the standard application of USG, measurements are challenging in circumstances such as maternal obesity, motion blurring, missing boundaries, acoustic shadow, speckle noise and a low signal-to-noise ratio. AI is being applied and actively studied in obstetrics for fetal biometry, identification of fetal structures and gross fetal imaging.[3] A semi-automatic program which automatically performs fetal body parts measurements using an AI algorithm after the sonographer or doctor selects an appropriate image of each body part is being used. In 2020, the *International Society of Ultrasound in Obstetrics and Gynaecology* concluded that in addition to identification and measurement of fetal parts, AI systems have been developed which can suggest a suspected diagnosis based on the measured values. The day is not far away in the future, when an ultrasound probe placed on a mother's abdomen will not only measure basic parameters, but also provide related diagnosis and further treatment directions.

Fetal Echocardiography: Fetal Echo is an essential imaging modality in perinatal care as it helps in diagnosing and monitoring intrauterine growth restriction, twin-to-twin transfusion syndrome, and congenital heart anomalies. *Fetal Intelligent Navigation Echocardiography 'FINE'* was developed for detecting fetal congenital heart anomalies.[3] However, it is challenging due to involuntary movements of the fetus, small fetal heart, fast fetal heart rate, limited access to the fetus, lack of experts in fetal echocardiography.

Fetal MRI: It is usually performed in obstetrics to discriminate fetal brain diseases and the severity of placenta previa.[3] AI helps in automatically analyzing the MRI scans and provide information on whether related treatments are needed along with a diagnosis. Application of AI techniques through MRI also helps in diagnosing the severity of placenta previa, PAS and distribution of vessels on the placental surface.

Fetal Heart Rate monitoring and CTG: AI can give a qualitative and quantitative overview of baseline FHR, variability, acceleration, deceleration, uterine contraction intensity, FHR pattern changes.[4] It helps by decreasing the discrepancies in the interpretation by different obstetricians and gives a more reliable and replicable output for each analysis. Thus, helps in reducing the perinatal and maternal complications and morbidity. The *Computerised Interpretation of Fetal Heart Rate During Labour (INFANT)* study protocol is a large trial currently evaluating the ability of AI interpretation of CTG during labor to assist practitioners in deciding the best management on an individual basis. *CAFE (Computer-Aided Fetal Evaluator)* also studied the possibility of an AI system being able to interpret CTG data and concluded that the AI system read the information at a similar level as the experts in the field and was also able to detect errors. AI technology can also be used for in-home pregnancy monitoring especially, in surveillance of high-risk patients.

Preterm Labour: Machine learning, particularly deep learning, has achieved good to excellent prediction of perinatal outcome in asymptomatic pregnant women with short cervical length in the second trimester. Currently, short cervical length is the strongest risk factor for prematurity. However, many women with this condition carry their pregnancy to term. *Singh et al*. studied the combination of AI and amniotic fluid proteomics and metabolomics, in conjunction or independently with imaging, demographic and clinical factors to predict perinatal outcome in asymptomatic women with short cervix. Amniotic fluid of the subjects was additionally studied for

omics like metabolomics and proteomics to shed light on potential new biomarkers that might be involved in preterm birth. Deep learning displayed good to excellent performance for prediction of preterm birth <34 weeks, delivery within 28 days after amniocentesis and NICU admissions. AI helps in stratification of patients at risk of preterm birth better than current risk factors like short cervical length and prior preterm delivery.

Several studies[5] used electrohysterography (EHG) signals and used three distinct machine learning algorithms to classify these signals for identifying true labour and accurately diagnosing preterm labour and had 97% accuracy in predicting preterm labour.

GDM Screening: Current screening method for gestational diabetes mellitus is costly and a burden for pregnant women. AI techniques can thus be used to screen GDM in a more cost efficient and less inconvenient way. Polak and Mendyk created an AI[6] calculator to screen for GDM using risk factors like high blood pressure, hyperlipidemia, smoking, weight, low fat diet and ethnicity.

HDP Screening: During pregnancy, the placental images of patients having hypertension deviate from those populations without hypertension. This can be used as a marker to predict hypertensive disorders of pregnancy (HDP), for it is a noninvasive, cost-efficient technique to promote future directions. Hence, utilization of AI to assess the variations in the placental ultrasound image texture of pregnant women with hypertension can prove to be beneficial. This could estimate adverse pregnancy outcomes even before the clinical manifestation of the disease.

Hypothyroidism in pregnancy: AI techniques/ ANN models can be used to check the intake of iodized salt, iodized supplements, and iodine rich-foods to predict the deficiency of iodine in the earlier pregnancy period, which aids experts in going for a feasible diagnosis.

Postpartum period: Pelvic floor dysfunction (PFD) is another general gynaecological disease. The major clinical manifestations are pelvic organ prolapse, sexual dysfunction, urinary loss, and faecal incontinence. A study was conducted to explore the application benefit of ultrasound technology and rehabilitation training, depending on AI algorithm in postpartum pelvic organ prolapse recovery and concluded AI algorithms possess good impacts in the processing of ultrasonic images. Thus, pelvic floor rehabilitation training had a better effect on postpartum nursing of pelvic organ prolapse patients.

IVF: AI can be used to predict IVF outcomes by using a learning vector quantizer which allows generalization and standard parameters for enhanced predictive power. It also has the possibility of identifying the most viable oocyte and embryos and to help clinicians predict pregnancy success rates as concluded by Manna et al.[7] The results proved to above average when compared to current methods and could help to select the best possible oocytes or embryos noninvasively and objectively.

AI in Gynaecology:

AI and ML are also being used to develop new tools for the management of gynaecological conditions, such as endometriosis and fibroids. These tools can be used to predict the progression of the disease and guide treatment decisions. AI algorithms can be used to identify patients at high risk of complications, prioritise them for care and ensure that they receive the appropriate level of care in a timely manner.[8]

One example of the use of AI in benign gynaecology is the development of computer-aided diagnostic systems for endometriosis. These systems use ML algorithms to analyse images of the pelvic region and identify the presence of endometrial tissue, which can be a sign of endometriosis. AI and ML are being used to analyse imaging data and predict the growth and behaviour of fibroids, which can aid in the development of personalised treatment plans.

AI in Gynaecological Surgery:

AI and ML are rapidly evolving fields that have the potential to revolutionise the field of surgery. These technologies can be used to assist surgeons in a variety of ways, from pre-operative planning to real-time guidance during procedures. One of the key areas where AI and ML are being applied in surgery is in image analysis. Another area where AI and ML are being used in surgery is in the development of robotic systems. Overall, AI and ML have the potential to significantly improve the field of surgery by increasing accuracy and precision, reducing the risk of complications, and improving patient outcomes.

AI in Gynaecological Oncology:

Artificial intelligence has been shown to enhance diagnosis, refine clinical decision making, and advance personalized therapies in gynaecological cancers. The rapid adoption of AI in gynaecological oncology will depend on overcoming the challenges related to data transparency, quality, and interpretation. In gynaecologic oncology, more studies have been conducted on cervical cancer than on ovarian and endometrial cancers. Prognoses were mainly used in the study of cervical cancer, whereas diagnoses were primarily used for studying ovarian cancer.[9]

Other Uses: In addition, different consumer-grade, wearable devices, including smart rings and smartwatches, could track semicontinuous physiological measures such as body temperature, heart rate variability, oxygen saturation, blood pressure. They also track other behaviour measures such as quality of sleep, sleep duration, the relative location of patients and their activity. The tracking process of those physiological parameters has obvious benefits for precise early pregnancy-related conditions determination, including gestational hypertension and preeclampsia.

Further, Three-dimensional (3D) printers could offer materials that mimic real tissues and supports trainees to get practice with the realistic model. 3-D imaging permits better deep perception than its two-dimensional counterparts, permitting the surgeon to generate preoperative plans by the dimensions and of tissues.

Conclusion:

AI has a promising future in overcoming diagnostic challenges and improving treatment modalities in Obstetrics. Further studies need to be done to decrease the bias when creating algorithms and to increase adaptability in the system, enabling the incorporation of new medical knowledge. Practitioners must also take safety measures to ensure that the analysis is valid and accurate. AI is not meant to replace practitioners but, rather to serve as an adjunct in decision making and will help clinicians to make more self-assured decisions. Despite the numerous advantages, there are certain difficulties and challenges associated with AI such as reproducibility, generalizability, human engagement, privacy protection, legal issues, systematic biases and improper labelling of data, leading to skewed results. However, it is essential to keep in mind that it is not a substitute for clinical experience.

Limitations of AI:

Main limitation of AI in healthcare is the potential for ethical and privacy concerns. AI systems in healthcare rely heavily on patient data, including sensitive medical information. There is a need to ensure that this data is collected, stored, and used in a secure and privacy-conscious manner. Protecting patient privacy, maintaining data confidentiality, and preventing unauthorized access to personal health information are critical considerations.

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Review Article

Project RIDA 100%
Rajgir Institutional Delivery Achievement 100%

S Siddhartha Sankar Reddy[1], Sarita Simba[2]

ABSTRACT

Institutional delivery provides an opportunity for timely management of intrapartum complications and reduces neonatal infections. It is estimated that around 40% of maternal deaths, stillbirths and neonatal deaths take place during labour and the day of birth.[1,2] Birth asphyxia, an Intra-partum complication, contributes 20% of neonatal deaths.[1] Quality care during labour and childbirth ensures early detection and prompt management of complications. Bihar accounts for over 3.2 million newborns every year. Only 63.8% institutional delivery (15% lower than the national average of 78.9%) and over 35% home deliveries was reported as per NFHS-4. Home delivery was found high particularly in pockets having migrant population or far away homes and populations with low education and awareness level. With the Project RIDA 100% (Rajgir Institutional Delivery Achievement 100%), an intervention model was tested in 2018 to demonstrate that a package of both facility and community-based interventions could lead to attain 100% institutional delivery in Rajgir Block of Nalanda District, Bihar. The evaluation findings showed an increasing trend of the Institutional delivery in successive quarters of 2018 and the finding was remarkable. Of the 21 reported home deliveries, 10 (47.6%) deliveries were in the first-quarter (January- March 2018), 6 (28.5%) in the second-quarter (April-June 2018), 5 (23.8%) in the third-quarter (July- September 2018) and no home delivery reported in the last quarter (October-December 2018). This apart, coverage of Four ANC visits within the recommended time was noteworthy, rising from 43.8% of pregnant women to 77.8% between in given time period.

Keywords: Institutional Delivery, Anti Natal Care, Bottleneck Analysis & Respectful Maternity Care.

Introduction

Institutional delivery provides an opportunity for timely management of intrapartum complications and reduces neonatal infections. It is estimated that around 40% of all maternal deaths, stillbirths and neonatal deaths take place during labour and the day of birth.[1,2] Intra-partum related complications/birth asphyxia contributes 20% of neonatal deaths.[1] Quality care during labour, childbirth, and in the immediate postnatal period not only prevents the onset of complications, but it also enables their early detection and prompt management. Bihar, being the third most

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populous state of the country, accounts for over 3.2 million newborns every year. Of these, more than 35% is home deliveries as per NFHS4, contributing to maternal and neonatal morbidity and mortality. In this context, the pilot project titled "RIDA 100% (Rajgir Institutional Delivery Achievement 100%)" was implemented in Rajgir Block of Nalanda District, in Southeast of Bihar.

Context:

In Bihar only 63.8% deliveries take place in health care facilities which was 15% lower than the national level (78.9%) as per NFHS-4. RIDA 100% was designed in January 2018 as a model to strengthen institutional delivery under MNH programme. Home delivery rate was found very high particularly in pockets having migrant population, in populations with low education status and awareness level and in homes which are far away from delivery centers. This pilot project unfolded many buried reasons like unofficial charging of money by the staff of facilities, less importance towards respectful maternity care, poor quality of care, poor accessibility, lack of referral transport facilities and social taboos as some of the factors refraining the pregnant women to avail quality institutional delivery services. Evaluation report of the pilot project recommended a number oflow-cost strategies and package of interventions to overcome the barriers and to promote institutional delivery across the state.

Methodology:

RIDA 100% Institutional delivery model piloted during 2018 with ultimate objective to demonstrate a proof of concept for widespread replication of the learnings to strengthen institutional delivery across Bihar. The pilot planned with the **Objective:**

a. To identify the Bottlenecks in Institutional Delivery and Reasons of high Home Delivery
b. To develop Strategies and activities for achieving 100% institutional delivery in Rajgir block of Nalanda District

Implementation Measures:

A. Mapping of High home delivery blocks:

- First, mapped all the high home delivery blocks of Bihar for equity analysis (Found 71 out of 534 Blocks are having home delivery more than 50%) by using Health Management Information System (HMIS) Data.

B. Situation Analysis/BNA: (Community, Facility and Enabling Environment)

- Through Bottleneck analysis (BNA) done to find out the major reasons of high home delivery and found that populations with low awareness, low literacy level in female, deep rooted cultural practices (don't like delivery by male staff, low male participation in decision making etc.), hospital far away, difficult roadway conditions, high migrant population, Non-availability of Aadhar Card/Bank Account etc.
- Mapping of all the available of delivery points, skilled service providers especially at the block facility & sub health center level, ambulance availability etc. (Only 41% of available ANMs are found trained for skilled birth attendant)

C. Stakeholder Mapping:

Mapping of the different potential stakeholders working in Bihar who can be engaged in this project, as this was not a simple pilot, but the moto was to test different intervention/hypothesis's which are fitting & not fitting with an ultimate objective was to improve institutional delivery across the state and alone by Health this was not possible. Apart from Health, other stakeholders identified who can support in the intervention are: JEEViKA- members of State Rural Live-hood Mission (SRLM), Self Help Groups (SHG), CARE, Social Mobilization Network (SMNet), ICDS Workers, Panchayati Raj Institution (PRI), Public Relations Department (PRD), Public Administration Department etc.

D. Selection of Block:

Rajgir Block was chosen based upon 3 criteria's (High Home Delivery, Routine Immunization (RI) High Risk Block & to bring Political Buy In- as this was CM's home constituency) (RI High Risk Blocks in terms of Coverage, Accessibility, Migration, Resistant etc.)

E. Implementation Strategy with Roadmap:

Based upon the above observations and stakeholder's consultation a Three-pronged implementation strategy with roadmap was developed with strategically viable specific facility & community-based interventions

were undertaken in the block to achieve 100% institutional delivery in Rajgir Block of Nalanda District.

Prong-I (Community intervention Model)- Major focus was to engage the JEEViKA, SHG, SMNET team members to execute the community level tasks along with ASHA, AWW, women's groups and village volunteers because it was totally difficult to achieve the desired results without effective participation of community. Though JEEViKA, SMNET & SHGs have not worked earlier in MNH area, however we choose them because of their in-depth understanding of community programming, practices, beliefs and needs of community.

Prong-II (Facility Intervention Model)- To engage Consultants to support Facility Gap Improvement, Capacity building of Staff, Expansion of Delivery Points and Quality assurance at the facility level services and to coordinate with the Block Health, ICDS, PRD, BDO & JEEViKA team. Facility Based Interventions included improved management and governance of Health Services and improved availability and quality of MNH services.

Prong-III (System & Governance Strengthening)- Strategic linkage with District Health & ICDS Officials, District Administration, PRD, State Health Society Bihar (SHSB), SRLM and CARE to address the pilot pitfalls through the Block Health Officials and Consultants.

Under the Improved Management and Governance of Health Services, Rajgir Pilot Project Core Committee (RPPCC) was instituted with the chairmanship of Civil Surgeon, Nalanda district and with weekly progress review mechanism. Quality Assurance Core Committee (QACC) was strengthened for labour room and OT room of Sub Divisional Hospital Rajgir. local resource allocation was increased for institutional delivery services by utilizing RKS fund on priority basis. village wise excepted level of achievement (ELA) of each sub-centre was updated and streamlined HMIS monitoring data for systematic progress review by RPPCC and QACC.

Under the Improved Availability and Quality of MNH services, supply chain was strengthened and ensured availability of functional equipment and adequate stock of consumables. Ensured 24-hour availability of clinical staff for core MNH services at SDH Rajgir and positioned 2 SN/ANM at APHC Rajgir. Labour room staffs were capacitated for improved clinical practices through training programmes such as MNH, Neonatal resuscitation program (NRP), infection control etc. Handholding support was provided to facilitate routine clinical discussions and use of LaQshya-Labour Room/OT Quality Improvement Initiative and Safe birth checklist by Staff Nurse/ ANM, filling up of case sheets & registers of labour room & OT, initiate patient satisfaction survey & feedback sharing for Respective Maternity Care.

Specific community Based Interventions included the following methodology:

I. Line listing of all pregnant mother and tagging of migrant/underserved/unserved mothers with nearby ASHA, ASHA Facilitator and ANM
II. Deployed "Tele-counselor" at the Block level for case-based tracking and follow up of the pregnant women and provide counseling support particularly to the most disadvantaged.
III. Facilitated JAGO campaign for awareness building and sensitization for institutional delivery.
IV. Facilitated mass awareness throughcrowd pulling events such as magic show, nukkad-natak, rallies and other IEC activities like hand bill distribution etc. by engaging a local NGO.
V. Strengthened women's and mothers' group networks and sensitized on safe motherhood. Imparted care seeking behavior through mothers' meetings in all gram panchayats of Rajgir block. Enhanced women's and their family's knowledge and confidence about the rights and entitlements in the ambit of MNH services.
VI. Improved mechanism to ensure referral transport through frontline health workers. Volunteers were identified in hard-to-reach areas (example in Bahera Village of Rajgir) to take responsibility for emergency transport.
VII. Undertaken systematic survey on knowledge, attitude and satisfaction level towards institutional delivery by undertaking 300 pre and 300 post community level interviews to understand the bottlenecks.

Results and Discussion:

The evaluation findings showed an increasing trend of the Institutional delivery in successive quarters of

2018 was found to be remarkable. Out of 21 home deliveries reported in 2018, 10 (47.6%) deliveries had been in the first quarter (January- March 2018), 6 (28.5%) in the second quarter (April-June 2018), 5(23.8%) in the third quarter (July- September 2018) and no home deliveries reported in the lastquarter (October-December 2018). Highest number of Institutional deliveries has been conducted in third (138) and fourth quarter (137) of the life span of the pilot, i.e. 2018. As the purpose of the project was to test whether a package of both facility and community-based interventions could lead to attain 100% institutional delivery in Rajgir, the above-mentioned result endorses the theory of change and fits with international evidence and overall achievement of RIDA 100%.

Besides, there were several outcome level results achieved through this pilot intervention. There was a significant increase in reported four ANC visits (4 ANC) made at the recommended times, rising from 43.8% of pregnant women to 77.8% between in given time period. *Similarly*, there was a major increase in the institutional delivery rate, rising from 55% to 100%. *Also*, there is decline in home delivery from average number per month of 11 to 0. Similarly, improvement in essential newborn care practices was conspicuous. More positively, institutional delivery increased among the disadvantaged women marking an equity achievement.

The facility and community level intervention package contributed to improving the overall MNH services in the block in general and quality of services at facility and community level in particular.

Small flexible grants managed at block level to create an enabling environment at the health facility. Quality ANC camps were organized by using PMSMA platform.

The facility obtained license for blood bank at the sub divisional health facility. An additional delivery point made functional at APHC Amirganj. Health Management Information System (HMIS) was strengthened through systematic review processes. Social and community mobilization for behavior change enhanced demand for facility-based care. Strengthened women's and mothers' groups and networks engaged in mass sensitization on safe delivery practices.

Recommendation:

The pilot project recommended a numerous low-cost core strategies and package of interventions designed to overcome the barriers and to promote the institutional delivery via piloting in one block of the blocks of 38 districts of Bihar to emphasize the development & implementation of cost-effective strategies for maternal and newborn health (MNH), in the next health sector programming of Bihar.

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Statement: *"We confirm that the article is original, and is not under consideration by another journal. We sign for and accept responsibility for releasing this article."*

Conflicts of interest: NIL

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Original Article: Obstetrics

BMI (WHO International versus Asian Criteria) in Early Pregnancy and Pregnancy Outcomes: A Single Centre Prospective Study

Sujata Singh[1], Renu Singh[2], Anjoo Agrawal[3], Mona Asnani[4]

ABSTRACT

Objective: Maternal BMI is a good indicator of maternal nutritional status. Being overweight, obese or underweight carry adverse effects on the mother as well as the fetus. Our objective was to classify pregnant women in early pregnancy according to WHO International and Asian BMI cut-offs and compare their pregnancy outcomes.

Methods: It was a prospective observational study over a period of one year. Women who had antenatal visit within 14 weeks of gestation and delivered in our hospital were included. A total of 209 women were available for analysis.

Results: Mean age of the cohort was 28.1±3.9 years. As per Asian BMI cut-offs, 34.9%, 17.2%, 47.8% women had BMI in normal, overweight, and obese range respectively. However, on WHO BMI cut-offs, 52.2%, 37.3% and 10.5% of women had normal, overweight, and obese range respectively. Hypertensive disorders of pregnancy and gestational diabetes was the commonest antenatal complication. Caesarean delivery had significant association with overweight and obese women. Asian BMI cut-offs had significant predictability for antenatal complications. Sensitivity, specificity, and positive predictive value of Asian BMI were 69%, 68.2% and 94.9% when compared with 50.8%, 77.3% and 92% of WHO BMI.

Conclusion: Asian BMI has high sensitivity in predicting adverse pregnancy outcomes.

Key words: Pregnancy, outcome, Asian, WHO, BMI

Introduction

In recent years, WHO has recognized obesity as a global health burden. The contributory factors include changes in the socioeconomic conditions, lifestyle and food habits. Women predominantly are more affected than men.[1] Obesity poses a serious challenge, as obese pregnant women have increased risk of maternal and perinatal complications.

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The maternal complications include hypertensive disorders of pregnancy, gestational diabetes, operative vaginal delivery, cesarean delivery, postpartum hemorrhage and increased infection rates. Birth defects, macrosomia, increased admissions to neonatal intensive care unit are the neonatal complications in obese women.[2,3]

The National Family Health Surveys (NFHS) in India indicated an increase in obese women from 15% in NFHS-3 to 20.6% in NHFS-4 (2015-16) to 24% in the NHFS-5 (2019-21).[4] Obesity can reliably be measured by body mass index (BMI). BMI is a simple index of weight for height and is irrespective of age and sex of the population. The weight is measured in kilograms and is divided by square of height in meters (kg/m^2). The American College of Obstetrics and Gynecology (ACOG) recommends recording of BMI at the initial prenatal visit and counsel women as per their BMI status regarding the maternal and fetal risks.[5]

Asian Indians have increased abdominal obesity, increased intra-abdominal fat deposition and ectopic site fat deposition. This puts them at high risk of adverse outcomes even at lower BMI. The Asian BMI classification has a lower cutoff for overweight and obese categories when compared to the WHO International classification.[6]

We did this study to find out early pregnancy (<14 weeks) BMI in women attending antenatal clinics and classifying them according to WHO International BMI & Asian BMI classification. The maternal and neonatal outcomes were compared between the two BMI groups.

Material and methods

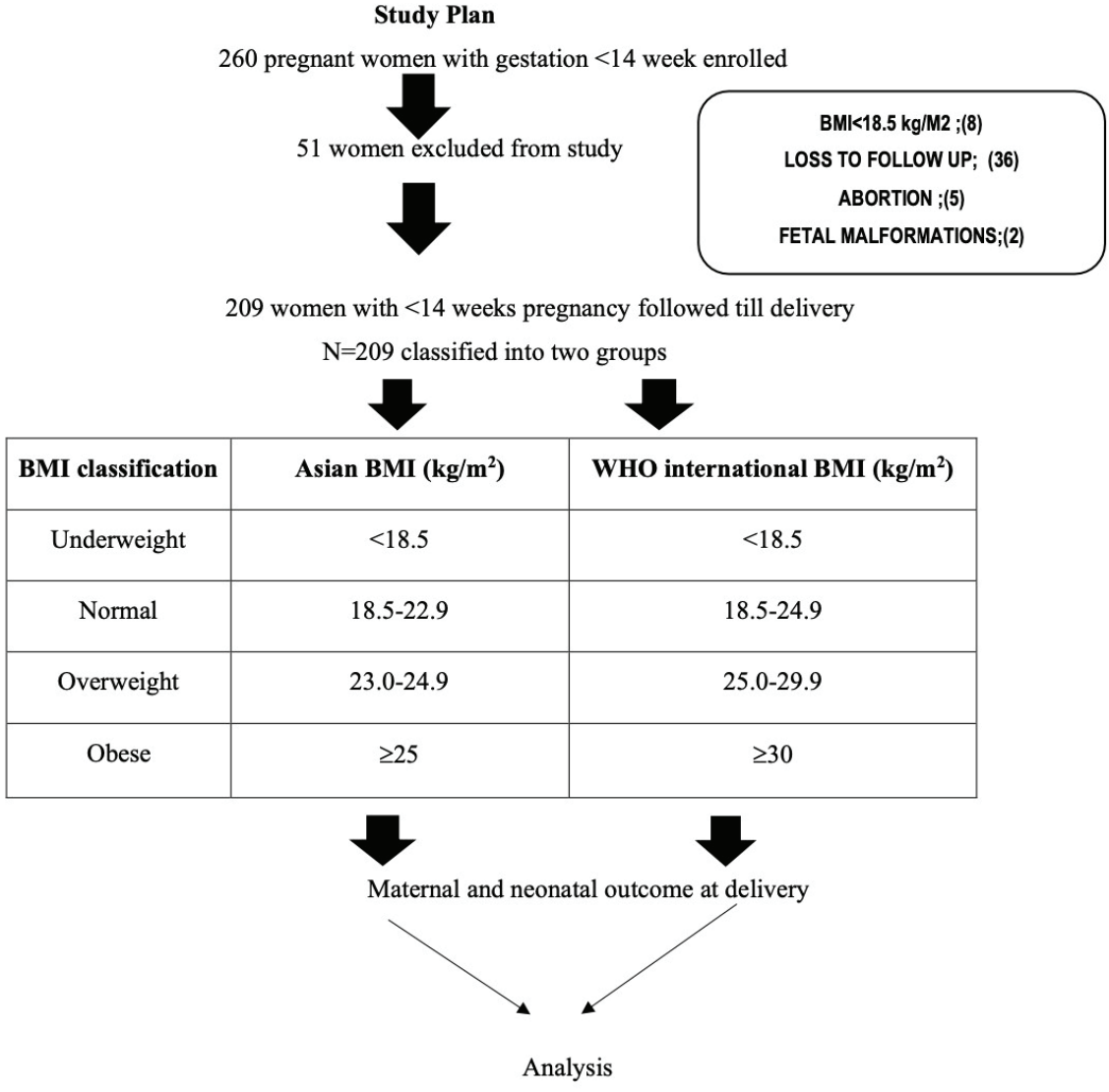
This was a prospective observational study done over a period of one year in a tertiary care teaching hospital in North India. The study was approved by the Institutional Ethics Committee [ECR/262/Inst/UP/2013/RR-19]. Pregnant women presenting to antenatal clinic below 14 weeks gestation were included. The gestational age was calculated from the last menstrual period and was confirmed by ultrasound. All gave informed consent. Women with BMI <18.5 kg/m^2, multiple pregnancy and with coexistent medical disorders were excluded. All were subjected to detailed history and clinical examination. Height was measured without shoes by a wall-mounted measuring tape with an accuracy of 0.5 cm. Weight was measured on a standard scale with an accuracy of 100gm. BMI was calculated using Quetelet's index [Weight (kg)/Height (m^2)] .Thereafter, women were classified according to WHO International BMI and Asian BMI cutoffs(fig.1) All were subjected to routine antenatal investigations including blood sugar (2 hour post 75 g glucose load) as per DIPSI guidelines. Dietary counseling and recommended weight gain advice were given as per their BMI. Further antenatal care was performed as per protocol. Antenatal progress was noted at each visit. Fetal growth was assessed by maternal weight gain, obstetric examination, and ultrasonography. All were followed till delivery. The primary outcomes were the development of pregnancy complications like gestational diabetes, hypertensive disorder of pregnancy (HDP), preterm labor, prelabor rupture of membrane (PROM), FGR (fetal growth restriction), APH (antepartum hemorrhage), intrahepatic cholestasis of pregnancy. The secondary outcomes observed were the mode of delivery, postpartum hemorrhage (PPH), subinvolution of uterus and surgical site infection (SSI). The neonatal outcomes noted were gestational age at delivery, APGAR score, birth weight ,any admission to NICU (neonatal intensive care) and neonatal death.

Statistical analysis

The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 21.0 (IBM Inc., USA). The values are represented in number, percentage (%) and mean±SD. Chi-square and ANOVA tests were used to compare the data. A 'p' value < 0.05 was considered significant. Predictive efficacy of WHO International and Asian BMI cutoffs was assessed in terms of sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV)and accuracy.

Results

A total of 260 antenatal women with gestational age less than 14 weeks were enrolled for the study. However, only 209 were available for the final analysis. (fig.1) The mean age of the cohort was 28.1±3.9 years. Majority of the women were multigravida, had education up to intermediate level and were residing in urban areas. Of all,39.2% were in lower middle



BMI classification	Asian BMI (kg/m^2)	WHO international BMI (kg/m^2)
Underweight	<18.5	<18.5
Normal	18.5-22.9	18.5-24.9
Overweight	23.0-24.9	25.0-29.9
Obese	≥25	≥30

Figure 1

socioeconomic status class and only 8.6% belonged to upper socioeconomic status class.

When women were classified as per WHO International BMI cutoff, 109/209 (52.2%) were normal; 78/209 (37.3%) overweight and 22/209 (10.5%) obese. However, 73/209 (34.9%) were normal, 36/209 (17.2%) overweight, and 100/209 (47.8%) were obese when women were classified using the Asian BMI cutoffs. Of the 109/209 women, classified as normal as per WHO International cutoffs, 36 women were reclassified as overweight, and 78 women turned obese from overweight when subjected to Asian BMI cutoffs. Table 1 shows the high-risk pool cohort after applying the Asian BMI cutoffs.

Table-1: BMI (WHO versus Asian criteria): The high-risk pool cohort after Asian BMI cutoffs

WHO BMI Criteria	Asian BMI Criteria			Total
	Normal	Overweight	Obese	
Normal	73	36	0	109
Overweight			78	78
Obese			22	22
	73	36	100	209

BMI: Body Mass Index, figures in bold indicates number of subjects added to high risk pool

Of all, 187(89.4%) women developed pregnancy complications. Hypertensive disorder of pregnancy (34.4%) was the commonest complication observed, followed by gestational diabetes (31.6%) and anemia in 29.2% women. The other complications observed

were intrahepatic cholestasis of pregnancy (19.6%), fetal growth restriction (19.1%), prelabor rupture of membranes /preterm labor (11.5%), and antepartum hemorrhage (1.9%). Considering overweight and obese as high-risk women for developing antenatal complications, the sensitivity, specificity, PPV, NPV of BMI cutoffs by WHO and Asian criteria were calculated. The Asian BMI cutoffs (OR 4.7; [95%CI 1.8-12.3]) had higher odds of diagnosing antenatal complications when compared to WHO BMI cutoffs (OR 3.5; [95%CI: 1.2-9.9]). Table 2, Table 3.

Table-2: Predictive efficacy of Asian BMI cutoff for prediction of antenatal complications

*High risk	Antenatal complications		Total
	Present	Absent	
Yes	129	7	136
No	58	15	73
Total	187	22	209

High risk*: includes overweight and obese women as per Asian BMI cutoffs; sensitivity: 69%; specificity: 68.2%; PPV: 94.9%; NPV: 20.5%; Accuracy: 68.9%; Odds Ratio: 4.7 [95% CI 1.8-12.3]

Table-3: Predictive efficacy of WHO BMI cutoff for prediction of antenatal complications

*High risk	Antenatal complications		Total
	Present	Absent	
Yes	95	5	100
No	92	17	109
Total	187	22	209

High risk*: includes overweight and obese women as per WHO BMI cutoffs; sensitivity: 50.8%; specificity: 77.3%; PPV: 92%; NPV: 15.6%; Accuracy: 53.6%; Odds Ratio: 3.5 [95% CI 1.2-9.9]

In the cohort, 185/209 (88.5%) women had delivery at term whereas 24/209 (11.5%) had preterm delivery. 48.8% (102/209) women went into spontaneous labor while 51.2% (107/209) required induction of labor. The indications for labor induction were preeclampsia (27.8%), intrahepatic cholestasis of pregnancy (18.6%), fetal growth restriction (14.9%), gestational diabetes (10.2%) and prelabor rupture of membranes (9.3%). Table 4 shows the mode of delivery in groups when classified by WHO International and Asian BMI cutoffs. A significant association between higher BMI and cesarean delivery was observed. Of all who delivered vaginally,8.9% required assisted vaginal delivery.

Table 4: Association of BMI cutoffs (WHO and Asian) with Mode of delivery

BMI Criteria (number)	Mode of delivery		P value
	Vaginal (n=90)	Cesarean section (n=119)	
WHO			
Normal (109) Overweight (78) Obese (22)	56 31 03	53 47 19	0.004
Asian			
Normal (73) Overweight (36) Obese (100)	41 15 34	32 21 66	0.01

Postpartum hemorrhage, subinvolution of uterus were higher in the obese group but was not significant statistically. Amongst all,32/209(15.3%) women developed surgical site infection. Obese women, both by WHO International and Asian cutoffs had significant association with surgical site infection ($p<0.001$ and $p=0.03$ respectively).

Of all, 147/209 (70.3%) neonates had birth weight ≥ 2500 g while 62/209 (29.6%) had low birth weight. Both WHO International and Asian BMI cutoffs did not show any significant association with APGAR score at 5 minutes of birth. Large for gestational age (LGA) infant and neonatal jaundice was observed more in neonates of obese women. There were no neonatal deaths.

Discussion

Overweight and obesity poses a major global public health challenge. There is an alarming increase in the proportion of overweight /obese Indian women. It has increased from 12.6% in 2006 to 20.7% in 2016.[7] The recent NFHS (2019-21) shows that about 33.2% of urban, and 19.2% of rural women are overweight or obese. Overall, 24% of Indian women belong to overweight or obese population.[4] The reasons attributed are globalization, consumption of energy dense, nutrient poor food, sedentary lifestyle, sedentary occupation, reduced physical activity as the major drivers of the global obesity epidemic.[7] The mean age of women in our cohort was 28.1+-3.9 years. Majority of cases (52.6%) were in 26–30 year age group. However, proportion of those aged >30 years were higher in the obese group. It was observed that overweight and obese women were significantly older, had higher education and were multigravida.

Older maternal age, urban residence is said to be associated with increased odds of obesity among pregnant women.[7]

In our cohort, 47.8% women were obese as per Asian BMI cutoffs which is approximately five times higher than the WHO BMI cutoffs. WHO cutoffs are mainly based on western standards. Asian Indians have increased abdominal obesity, subcutaneous fat and excess intrabdominal fat deposition which puts them at high risk of adverse outcomes even at lower BMI cutoffs. Beena et al. in their study observed that prevalence of overweight and obesity increased when Asian Indian BMI cutoffs were applied and hence concluded that Asian BMI seems to be a better alternative to WHO BMI.[8]

Amongst the antenatal complications, HDP, gestational diabetes and anemia were the commonest complications. Overall, HDP was observed in 34.4% women. In our cohort, 84.7% of high-risk women developed HDP as compared to 70% of high-risk women when Asian and WHO BMI cutoffs were used respectively. Further, 31.6% women developed gestational diabetes. Of them, 80% belonged to high-risk group in comparison to 66.6% when Asian versus WHO BMI cutoffs were used. The Asian BMI criteria had higher sensitivity and accuracy in diagnosing antenatal complications. In India, anemia during pregnancy is a significant public health problem, with 45.7% of pregnant women in urban areas and 54.3% women in rural areas having anemia.[4] The integrated three-pronged approach includes increasing iron intake and hemoglobin status in all family members through dietary diversification and use of iron fortified iodized salt, operationalizing hemoglobin estimation in all pregnant women for early detection of anemia, providing iron folic acid (IFA) medication at an appropriate dosage to pregnant women and monitoring for improvement following IFA therapy. This can help achieve the SDG target for anemia reduction in reproductive age group women.[9]

In our cohort, the proportion of women requiring induction of labor was higher in overweight and obese as compared to normal BMI women in Asian (53% vs 49.3%) and WHO (55.1% and 49.5%) cutoffs. Studies have shown an increased need of induction of labor in obese women. In study by Sharadha et al, labor induction was significantly high in the obese group (52.4%) when compared with 22.6% in normal group women.[10] Furthermore, obese women are at increased risk of failed induction.[11] In our study delivery by cesarean section occurred more frequently in obese women. Similar observations regarding high cesarean delivery rates in obese group has been reported by different studies.[8,10,11,12] Suboptimal uterine contractility or increased fat deposition in pelvic soft tissues has been speculated as the reason for increased cesarean rates in obese group women.[11]

Observational studies have shown an increased risk of postpartum complications like thromboembolism, infection and hemorrhage in the obese mother.[13] However, in our overweight and obese women, postpartum hemorrhage (PPH) was high, though not significant. PPH in obese women has been attributed to increased bleeding from a larger area of placental attachment because of macrosomia, large volume of distribution in these women and thereby decreased bioavailability of uterotonic agents.[11] Obese women in our cohort had significantly more surgical site infection than the normal and overweight ones. Studies have found wound infections to be more common in the obese women. The association of wound infection with obesity remain significant even when the procedure is elective and prophylactic antibiotics are administered.[14]

Large for gestational age babies were higher in overweight and obese women. Studies have shown that obese women have increased chances of delivering large for date babies.[15] The contributory factors likely are increased insulin resistance and higher plasma triglyceride levels in the fetus. The placental lipases cleave the triglycerides thereby transferring the free fatty acid to the fetus. The combination of fetal hyperinsulinemia and increased fatty acid delivery to the fetus can account for the increased birth weight in overweight and obese women.[16,17]

In the last few decades prevalence of women being overweight or obese is increasing thereby leading to antenatal complications like HDP, gestational diabetes, failed induction, and high cesarean rates. Effective interventions to reduce the prevalence of overweight and obesity in pregnant women could have significant beneficial effects on the pregnancy outcomes. For better pregnancy outcomes, the optimal care should begin in the periconceptional period.

Conclusion

There is an urgent need of public health efforts to promote weight management among women of reproductive age before conception or during pregnancy. Maternal overweight and obesity are important contributors to pregnancy complications and adverse outcomes. The use of Asian BMI cutoffs led to a larger proportion of obese and overweight women. The Asian cutoffs had higher sensitivity and accuracy of diagnosing antenatal complications.

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Conflicts of interest:

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Original Article: Obstetrics

Optimal Length of Stay for Maternal and Neonatal Care in Indian Settings

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ABSTRACT

Background: Maternal and neonatal health requires skilled care and evidence-based practices to minimize morbidity and mortality. Effective clinical and nonclinical interventions, infrastructure, and trained professionals ensure high-quality care. Cloudnine Hospital Network (CHN) has strategically reduced Length of Stay (LoS) resulting in cost reduction.

Objective: This retrospective study aimed to identify factors influencing LoS after delivery at the CHN to optimize postpartum care in India.

Methods: Data from CHN hospital records (January 2007 - 2023, covering 156000 deliveries, were analyzed for LoS associated with normal vaginal and cesarean deliveries.

Results: The mean LoS was 2.67±1.65 days. Normal vaginal and cesarean deliveries had mean LoS of 2.63±1.41 days and 2.75±2.08 days, respectively. The LoS was shorter than the national averages with over 80% discharged by the second and third days post-delivery.

Conclusion: Risk assessment and post-natal care must balance with functional recovery and resource utilization. The LoS should be individualized based on health, caregiving capabilities, and follow-up access. Enhanced recovery programs, like the Monarch Centre model, have notably reduced LoS, particularly for cesarean deliveries. Innovative post-discharge support through telemedicine and outpatient clinics complements high-quality, evidence-based practices, essential for improved maternal outcomes with shortened LoS.

Keywords: Delivery, obstetric; length of stay (LoS); patient discharge; postnatal care; pregnancy; postpartum period; enhanced recovery; cesarean section; India; quality of health care

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Introduction

Meaningful gains in maternal and neonatal outcomes can be obtained by extending high-quality care with appropriate risk assessment. Such care is necessary to ensure that mothers survive pregnancy and childbirth with minimal injuries and disabilities; this is necessary for the overall health and well-being of the mother and baby. Currently, the global maternal and neonatal mortality rates are about 223 deaths per 100,000 live births[1] and 18 deaths per 1000 live births,[2] respectively. Many of these deaths are preventable, especially in low- and middle-income countries (LMICs), where the burdens of adverse maternal and neonatal outcomes are especially high. The maternal and neonatal mortality rates in India are 97 per 100,000 live births[3] and 25 per 1000 live births,[4] respectively.

There is a need to ensure that skilled care and evidence-based practices are provided to restrict preventable maternal and newborn morbidity and mortality. Providing this quality of care requires the effective use of clinical and nonclinical interventions, strengthened infrastructure, and optimal skills and attitudes in healthcare providers.[5] The following thematic areas have been outlined as being of high priority for the highest impact on maternal and newborn care:[6] (a) labor monitoring and essential newborn care; (b) management of preeclampsia, eclampsia, and their complications; (c) management of postpartum hemorrhage; (d) management of difficult labor with appropriate medical interventions; (e) newborn resuscitation; (f) management of preterm labor, birth, and appropriate care of preterm babies; and (g) management of maternal and newborn infections.

Adequate length of stay (LoS) allows for the monitoring and management of postpartum complications and provides the necessary support. However, increased LoS is associated with an increase in the cost of services.[7] Therefore, understanding the relationship between LoS and optimal outcomes is crucial for healthcare providers, policymakers, and researchers seeking to improve the quality of maternal and neonatal care, especially in resource-constrained settings. The LoS is a conveniently available indicator that reflects hospital activity and provides an indirect estimate of resource consumption and efficiency.[8,9]

The rates of cesarean deliveries worldwide have increased almost three-fold in the last decade (from 7% (in 1990 to 21% in 2021), and are estimated to increase to 29% by 2030.[10] Cesarean deliveries are more prone to complications and extended hospital stays than vaginal deliveries.[7,11,12] However, with the adoption of enhanced recovery after surgery (ERAS) programs, the LoS can be reduced considerably without an increase in hospital readmission.[13–15] Nevertheless, further investigations of postoperative care, especially focusing on the optimal LoS and successful implementation of the ERAS program, are much needed.

Materials and Methods

Study design: This was a retrospective study conducted using data collected from hospital records at the Cloudnine Hospital Network (CHN) between January 2007 to January 2023. The data was collected across 29 branches of the CHN in India.

Ethics statement: Since this was a review of retrospective data without patient identification data, ethical approval was not required for this study.

Delivery protocols: The following steps were followed at all CHN hospitals, which offer 2 nights and 3 days package for both NVD (normal vaginal delivery) or LSCS (lower segment cesarean section):

1) All pregnant women were educated about labor, delivery, and recovery (LDR) through antenatal classes.
2) Women who underwent LSCS or NVD were encouraged to walk within 4 to 6 hours after delivery to promote early mobilization.
3) All babies were checked by an experienced pediatrician or neonatologist at birth.
4) All mothers were seen by a physiotherapist and lactation consultant soon after admission to the hospital.
5) Babies were encouraged to breastfeed within 30 minutes of birth irrespective of whether they were delivered by NVD or LSCS.
6) Physiotherapists supervised the early mobilization of all mothers in the first 24 hours after delivery and post-natal exercises were begun in the first 24 hours itself.

Results

There were 156,000 deliveries between January 2007 to January 2023, of which 95,160 (61%) were LSCS deliveries and 12,720 (8.2%) were instrumental deliveries (forceps and vacuum extraction for various maternal indications); the remaining were NVDs. Of these, 1248 cases (0.8%) had LoS >3 days (up to 5 days) due to maternal hypertension (either pregnancy-induced hypertension (PIH) or essential hypertension), cardiac diseases, or maternal fever. All others were discharged after 2 nights and 3 days. All cases were followed up for consultations with a senior obstetrician within a week of discharge.

Only 3 maternal deaths have occurred (maternal mortality rate [MMR] is 2 per 100,000). For babies delivered after >28 weeks of gestation, the survival rate is 99.8%. The neonatal mortality rate is 2 per 1000 live births, indicating high survival. Postpartum infection rates were 0.6%, which is much lower than the 5%–7%, which is the reported rate in the US.[16] Pelvic floor damages were virtually nil and 95% of the mothers were successfully breastfeeding at the time of discharge. The CHN is the only hospital chain from Asia to be part of the VON (Vermont Oxford Network).

The mean LoS for all deliveries was 2.67±1.65 days (data from November 2022 to April 2023). The mean LoS for normal and cesarean deliveries were 2.63±1.41 days and 2.75±2.08 days, respectively. A comparison of the LoS at CHN with those from other published studies is provided in Table 1. The percentages of patients staying in the hospital for different durations of time are provided in Figure 1. A comparison of the data on LoS at the CHN with those from a nationwide study by Kumar *et al*. (2020) is provided in Table 2.

Table 1: The average length of stay (LoS; in days) reported by different studies

Study	Normal delivery	Cesarean delivery	Study area
Hassan et al., 2022[17]	-	2.7	Eastern Sudan
Federspiel et al., 2020[18]	-	2.7	US
Kumar et al., 2020[7]	2.1	8.6	India
Campbell et al., 2016[12]	1.3–6.6	2.5–9.3	92 countries
Kruse et al., 2020[19]	-	2.4	Denmark
Acharya, 2016[20]	4	7	Nepal
Cloudnine Hospital Network	2.63	2.75	25 sites (India)

Table 2: Proportion of patients (%) with different lengths of stay (LoS): A comparison of nationwide data with CHN data

	Normal			Cesarean			Total		
LoS (days)	Public	Private	CHN	Public	Private	CHN	Public	Private	CHN
0	23.4	19.2	0.4	6.7	4.3	0.6	21.2	12.8	0.4
1	22.6	24.6	4.7	5.6	3.5	3.6	20.3	1.5	4.4
2	18.8	20.3	43.3	4.3	3.0	34.4	16.9	12.8	40.6
3	25.1	20.8	42.2	6.3	8.6	50.8	22.6	15.6	44.8
4	3.0	4.5	7.1	4.6	8.4	8.2	3.2	6.2	7.4
5	2.6	4.8	1.3	10.0	18.3	1.6	3.6	10.7	1.4
6	0.8	1.2	0.4	7.8	9.1	0.4	1.7	4.6	0.4
7	2.0	2.8	0.2	36.3	31.6	0.2	6.5	15.2	0.2
>7	1.8	1.8	0.4	18.5	13.3	0.2	4.0	6.8	0.3

Nationwide data were gathered from the study by Kumar et al., 2020.[7]
CHN: Cloudnine Hospital Network; LoS: Lengths of stay.

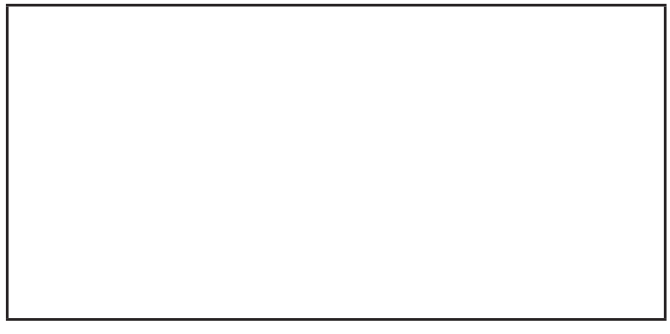

Figure 1: Percentages of women (normal/Cesarean /total) with different lengths of stay (LoS) at the Cloudnine Hospital Network (CHN).

Comments

a. Principal findings

The Cloudnine Hospital Network (CHN) has adopted a protocol-driven ERAS program for maternal and neonatal care as indicated above. This has not only helped reduce maternal and neonatal morbidity and mortality but has also helped in reducing the costs involved in childbirth. The percentages of patients with different LoS are highly variable in the nationwide data. However, >80% of patients at the CHN were discharged on the second and third days after hospitalization.

b. Results in the context of what is known

In addition to the several factors that affect the functional recovery of the mother and newborn, hospital characteristics (e.g. capacity constraints) also affect the LoS.[21] Although the LoS varies considerably across countries, the determinants affecting the LoS

can be segregated into the following categories:[12,22] (a) patient characteristics; (b) clinical caregiver characteristics; (c) social or family environment characteristics; and (d) characteristics of the healthcare system. There is a lack of data from LMICs regarding the LoS after childbirth, as most studies in this field rely on data from high-income countries.[23] Despite scarce data, some patterns regarding the LoS are apparent in LMICs; for example, lower literacy levels, rural locations, and lower economic status are positively associated with shorter LoS after hospitalization for childbirth and this pattern is likely driven by a lack of awareness and unaffordability of care.[7] Although the mean LoS after childbirth is longer in private health facilities than in public health facilities for normal deliveries, for cesarian deliveries, the mean LoS is more extended in public health facilities than in private health facilities. This could be because of the higher occurrence of complications in cesarean cases in public health facilities than in private health facilities.

c. Clinical implications

Postpartum complications after cesarean deliveries are of significant concern for healthcare services. A thorough assessment is required to optimize the LoS to ensure a balance between functional recovery and resource usage. While a very short stay may not give caregivers sufficient time to detect and treat complications, longer stays expose postpartum women and neonates to higher risks of nosocomial infections, sleep disturbances, or poor infant-feeding support.[12] Another critical motivating factor for shorter postpartum stays is cost.[24] Although the LoS for postpartum women and neonates has progressively declined over the past decade,[25] the existing guidelines from different countries indicate that physical and psychosocial risk factors should be thoroughly considered before early discharge.[26] Therefore, the LoS after a cesarean section delivery will not only include the time required to recover from the surgery but also the time required to adapt to parenthood.[27]

The data also reveals that the extension of LoS after a risk assessment has facilitated the delivery of quality care to those in need. Appropriate risk assessment and post-natal care need to be examined before considering early discharge.[26,28] The practices adopted for the appropriate management of pregnancy-related complications, newborn care, and management of maternal and newborn infections show encouraging results.[6] Such practices, as applied at the CHN have limited maternal (2 per 1,00,000) and neonatal (2 per 1,000) mortality rates. The LoS should be evaluated based on the distinctive characteristics of the mothers and their infants.[28] Adequacy and access to appropriate follow-up care are also essential. Standardized processes, such as predischarge checklists, have been proposed to facilitate the uniform implementation of hospital discharge procedures after birth.[28] The discharge readiness should be assessed based on an assessment of maternal and neonatal health, the family's caregiving capabilities, and the availability of follow-up care.[28]

d. Research implications

Early discharge with an individualized follow-up program has shown promising outcomes for both the mother and newborn.[29,30] At-home visits by healthcare professionals can enhance patient satisfaction and outcomes.[31] However, such an approach is limited by the cost and increased need for trained professionals. Models, such as the Monarch Centre model, have been proposed and implemented to reduce postnatal LoS for mothers and newborns.[32] This model provides access to a community-based postpartum clinical care service, where women and newborns receive multidisciplinary care in an outpatient clinic during the first month following hospital discharge after delivery. Marked reductions in LoS were observed in this model, especially among women who had undergone cesarean delivery. Although reductions in the incurred costs have been the major focus of programs that aim to shorten LoS, the importance of patient experience and population health have also been highlighted.[33] Staffing and financial models for hospitals have shown that a reduction in the LoS results in less than proportionate savings in hospital cost due to the maintenance of contingent bed and staff capacity.[8] Models should include measures for ensuring monitoring of postoperative safety and promote continuity of standard postpartum care in outpatient clinics.[32] Women's reproductive care accounts for a considerable portion of hospitalization in India.[34] Measures to reduce the LoS in this group have the potential to translate to a high impact on the healthcare system. Women requiring larger abdominal incisions in cesarean delivery have benefitted from

measures to promote enhanced recovery via ERAS programs.[14] Other approaches for post-discharge patient support, such as the use of videoconferencing or mobile phone applications, have also been evaluated in this context.[35] Hospital readmission rates before and after the implementation of the ERAS program can be an essential indicator of the success of such programs.[36] If adequate continuity of care is provided in outpatient settings, hospital readmission can be reduced. However, specific subgroups, such as the mothers of late preterm infants, may require additional support, necessitating more personalized approaches to early discharge.

e. Strengths and limitations

This study benefits from the large dataset collected across the multiple centers of the CHN. It evaluates the impact of the enhanced recovery program implemented at the CHN, providing valuable insights into its effectiveness in Indian settings. While the study offers significant insights, its retrospective design may introduce bias, and its findings may not be easily generalized beyond the CHN. The short follow-up period post-discharge may also provide an incomplete picture of long-term outcomes. External validation in a diverse healthcare setting can enhance the applicability of this study.

f. Conclusion

Delivering high-quality care and using evidence-based practices, are both essential for improving maternal and newborn outcomes. This article highlights several areas for optimizing care, focusing on critical interventions that can have the highest impact. Postpartum complications following cesarean deliveries and risks associated with extended hospitalization must be taken into consideration when deciding on an optimal LoS. In this context, ERAS programs have shown promising results in improving postpartum care, reducing LoS, and enhancing patient satisfaction.

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Case Report: Obstetrics

Pregnancy And Delivery With Noonan's Syndrome: A Case Report

Souptik Gangopadhyay[1], Saurav Bose[2]

ABSTRACT

A 31 year old woman (known case of Noonan's syndrome with cardiac disease) presented with a singleton pregnancy at 26 weeks. She was delivered uneventfully.

Keywords: Noonan's syndrome, atrial septal defect, oligohydramnios.

This 31 year old primigravid mother presented to us for her first antenatal checkup in the outpatient department, carrying a singleton gestation of 26 weeks. She was unmarried, and a known case of Noonan's syndrome, having undergone intracardiac surgery for atrial septal defect (ASD) with pulmonary stenosis (PS) earlier, but still having a residual ostium secundum left to right ASD of 8mm. She had mild tricuspid regurgitation and right bundle branch block, with an ejection fraction of 63%. She was on levothyroxine (50mcg) replacement therapy for gestational hypothyroidism. Ultrasound revealed a singleton foetus in cephalic presentation, with oligohydramnios (amniotic fluid index = 4), normal foetoplacental Doppler patterns, and no foetal anomaly on earlier scans. Foetal echocardiography was normal.

At 32 weeks, she presented in the emergency with gradual onset dyspnoea. She was admitted in the critical care unit (CCU), and received supportive management in the form of appropriate antibiotics, nebulisation, oxygen support and close monitoring, including paediatric cardiology input and foetal surveillance via ultrasound and cardiotocography. The diagnosis was a mild lower respiratory tract infection, and she was discharged after 1 week in a stable condition.

At 35 weeks 4 days of gestation, she was admitted under us for safe confinement. All necessary investigations were done, and a detailed pre-anaesthetic evaluation and cardiological review were undertaken. Ultrasound showed a single live foetus at 33 weeks 3 days; cephalic, average liquor, upper anterior placenta, 2 loops of nuchal cord and normal Doppler studies. The modality of delivery was decided as elective Caesarean section, in view of foetal growth restriction with nuchal cord, and maternal cardiac condition. Antenatal steroids (betamethasone in standard 12mg doses) were administered 48 hours before surgery. Anaesthesia was provided as a single shot spinal in the L3-L4 interspace, using 2.2ml of 0.5% bupivacaine.

A Pfannenstiel incision and utilization of the Joel Cohen method during Caesarean were the cornerstones of our surgical technique. Low transverse incision was made over the uterus. She delivered a healthy baby girl of weight 1862g. Uterine closure was done in 2 layers,

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and the abdomen closed after securing haemostasis and matching counts, with subcuticular suturing to skin.

Post-operatively, she was shifted to the CCU for close monitoring. Post-surgical recovery was uneventful, and she was shifted to the ward after 24 hours of monitoring. Ultimately, she was discharged after 72 hours of surgery in a stable condition. The remainder of her post-partum period was uneventful.

Ethics Approval: As this was purely a case report without any intervention or analysis whatsoever, there was no research protocol involved. Consequently, Ethics Committee approval was not required.

Informed Consent: Written informed consent was obtained from the subject of this case report before the study began.

Author Contributions: Data acquisition, drafting and reviewing the work critically, final approval and accountability for all aspects of the work were shared equally between both authors.

Funding: None

Disclosure of Interests: The authors have no conflict of interest.

References: None.

Case Report: Gynaecology

Synchronous Primary Malignancies at Two Sites: A Rare Case Presentation

Miki Shah[1], Bibhushan Neupane[2], Rahul Deepak Modi[3], Pallav Gupta[4], Shashi Dhawan[5], Sabyasachi Bal[6], Mala Srivastava[7]

ABSTRACT

The diagnosis of multiple primary malignancy (MPM) is not uncommon. Nevertheless synchronous MPM involving endometrium and lungs is an extremely unusual event.

We report a case of 54 years old female patient who presented with abnormal uterine bleeding and was diagnosed as a case of fibroid uterus. She was incidentally found to have a nodular mass in left lung in chest x-ray. Contrast Enhanced Magnetic Resonance Imaging (CEMRI) and Whole body 18F-fluro deoxy glucose positron emission tomography- computed tomography (18 F-FDG PET-CT) revealed two distinct lesions- one in endometrium and another in left lung. Immunohistochemistry and biopsy from the endometrium and lung lesion were suggestive of endometrioid carcinoma and adenocarcinoma respectively.

Hence, the existence of two malignancies having different histopathologies at anatomically distinct sites suggests the diagnosis of synchronous dual primary malignancy involving the endometrium and the lung, which being a rare combination, prompted us to report this case.

Hence, the possibility of multiple primary malignancies existence should always be considered during pre-treatment evaluation.

Key words: Adenocarcinoma, carcinoma endometrium, immunohistochemistry, malignancies, primary malignancies, synchronous

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Introduction

The incidence of multiple primary cancers is reported to be 0.734% to 11.7%.[1] Despite its increasing rates, multiple primary malignancies (MPM) remain rare. Multiple primary malignancies in a single patient were first described in 1879 by Billroth.[2]

By definition, synchronous primary malignancies means two cancers detected at the same time or within 6 months whereas metachronous primary malignancies means one that follows the other after six months of diagnosis of first tumor.[3] A synchronously existing primary involving both organs in a single patient is a rarity in medical literature, prompting us to publish this case.

However, with the advent of advanced diagnostic imaging modalities, immunohistochemistry as well as increased efficacy of cancer therapy, the occurrence of multiple primary malignancy (MPM) is being identified with increased frequency[4] and also managed simultaneously and effectively.

Case

A 54 years old female, P2L2 with newly diagnosed Type II DM presented to outpatient department with complaint of abnormal uterine bleeding since past 2 years. There was no history of smoking. She did not have any family history of breast, endometrial or ovarian cancer. Her general and systemic examinations were normal. On per speculum examination cervix looked healthy while on per vaginal examination uterus was bulky and fornices were free. Basic blood investigations were normal.

On ultrasonography of pelvis uterus was bulky (10 x 5.9 x 4.9 cm) with three small fibroids; largest measuring 2.2 x 2.4 cm and 2.2 x 1.9 cm with endometrial thickness of 8.6 cm. Hence, hysteroscopy followed by dilatation and curettage was planned.

While evaluating the patient for surgical fitness chest X-ray revealed an incidental finding of a nodular lesion in left lower zone. Hence, a High Resolution Computed Tomography (HRCT) was performed showing a 3.2 x 2.4 cm nodular lesion with spiculated margins at lateral basal segments of left lower lobe (Figure 1). Endobronchial Ultrasound guided Trans Bronchial Needle Aspiration (EBUS- TBNA) revealed no evidence of cancer, tuberculosis and gram stain cultures. The patient underwent a Contrast Enhanced Magnetic Resonance Imaging (CEMRI) which revealed similar findings in left lung and uterus. Also, there was an asymmetric thickening of endometrium towards the left side likely due to endometrial polyp.

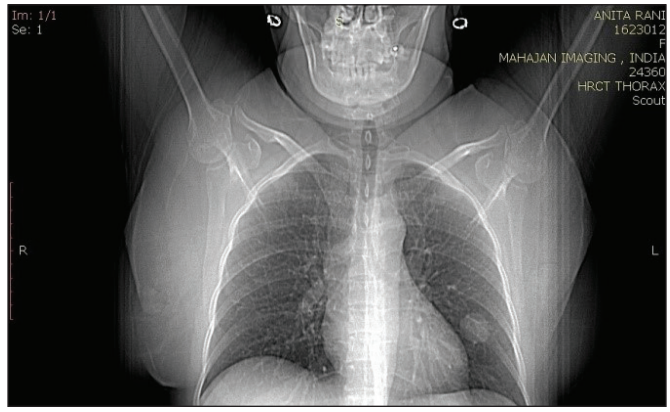

Figure 1: showing soft tissue attenuation nodular lesion; measuring 3.2 x 2.4 cm with lobulated outline and spiculated margins in lateral basal segment of left lower lobe, peripherally in subpleural location.

Further evaluation with Fluorodeoxyglucose whole body Positron Emission Tomography Computed Tomography (FDG PET-CT) scan conveyed FDG avid pleural based nodular lesion in lateral basal segment of lower lobe of left lung (Figure 2) and FDG avid hypodensity within the endometrial cavity (Figure 3).

Histopathology of CT guided lung biopsy indicated Non small cell carcinoma of lung; possibly adenocarcinoma. This was further supported by immunohistochemistry in which Thyroid Transcription Factor-1 (TTF-1), Sytokeratin 7 (CK-7) were strongly positive and Cytokeratin-20 (CK-20), Estrogen Receptor (ER), Progesterone Receptor (PR), Paired-Box Gene 8 (PAX-8) were negative indicating non small cell carcinoma of lung- adenocarcinoma.

After 5 days patient underwent hysteroscopy with dilatation and curettage. Histopathology of endometrial biopsy revealed endometrial carcinoma. Whereas, Estrogen Receptor (ER)- positive >90% moderate intensity, Progesterone Receptor (PR)- positive >90% high intensity, p53- focal patchy positive (wild type), p16- focal patchy positive, Napsin- negative in immunohistochemistry was suggestive of Endometroid carcinoma (FIGO grade I). The diagnosis of synchronous dual malignancy involving lungs and endometrium was thus conferred.

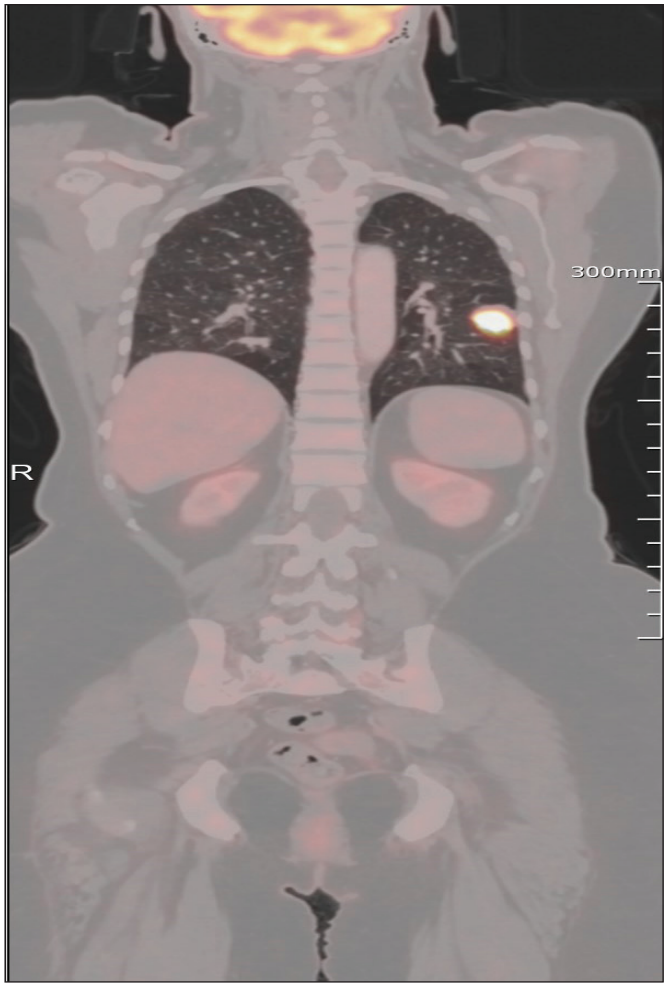

Figure 2: Showing pleural based nodular soft tissue lesion with spiculated margins noted in the lateral basal segment of lower lobe of left lung measuring 3.3 x 2.4 x 2.1 cm in size in PET-CT scan. The lesion is tethered to the left oblique fissure with fibrotic strands.

Patient underwent Video Assisted Thoracoscopic Surgery (VATS)- left lower lobectomy, mediastinal dissection along with Staging laparotomy for carcinoma endometrium- Hysterectomy with bilateral salpingoophorectomy and bilateral pelvic lymph node dissection with peritoneal washings in the same sitting. Intraoperative and postoperative period was uneventful. Histopathology of uterus concluded endometroid carcinoma of endometrium (Figure 4) involving fundus and body while regional lymph nodes were free of tumor (Stage I; Grade 1). Whereas, histology of left lower lobe revealed invasive solid adenocarcinoma (Figure 5); with no involvement of lymph nodes. (Stage I; Grade 2).This confirms that the patient had two synchronous primary cancers.

Initially we thought that we were dealing with carcinoma endometrium with metastasis to lungs or

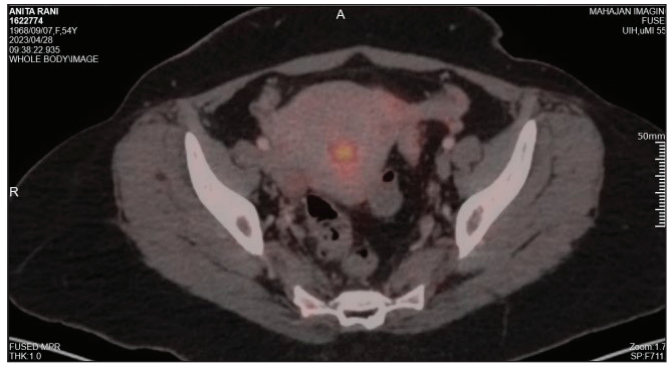

Figure 3: FDG avid hypodensity noted within the endometrial cavity

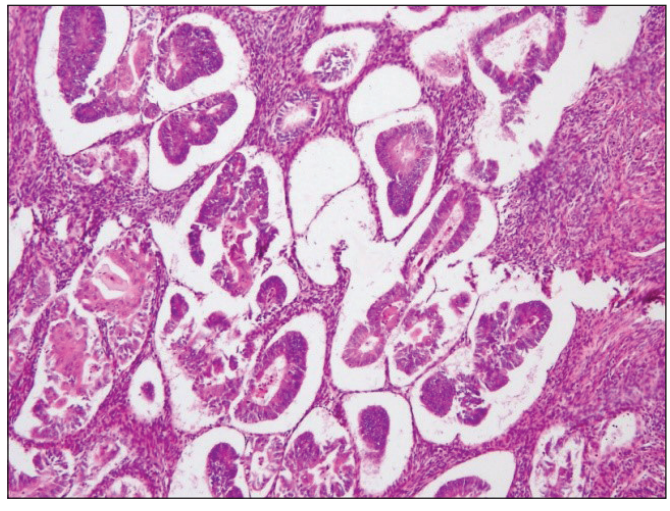

Figure 4: shows endometrial glands lying back to back with intervening stroma; suggestive of endometrial carcinoma

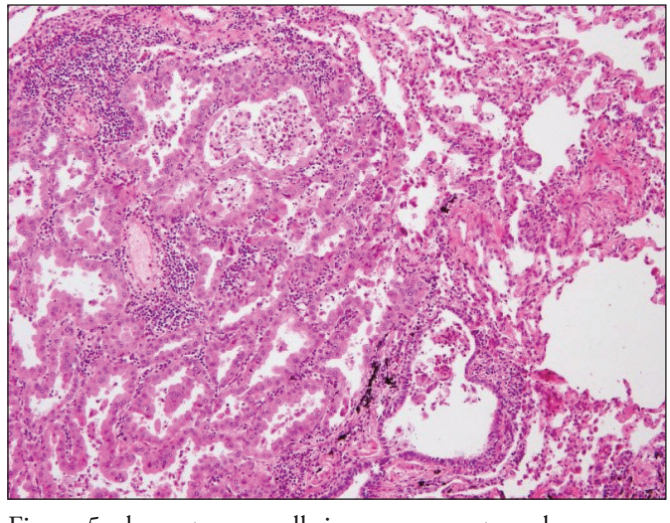

Figure 5: shows tumor cells in groups, nests and some forming glandular pattern. These cells are round to oval with high N/C ratio, hyperchromatic nuclei, moderate cytoplasm and prominent nucleoli in some. There is intense infiltration by inflammatory infiltrate; suggestive of adenocarcinoma of lung.

vice-versa which could have changed our diagnosis and staging but the histology and Immunohistochemistry (IHC) of both the tumors pointed out that we are dealing with two primary cancers. Henceforth, this gave us confidence to operate on both the primary tumors at the same sitting. Our patient stood the procedure well. Her postoperative period was uneventful and was discharged in fair condition.

Till date she is doing fine and is receiving chemotherapy with Pemetrexed and Carboplatin for 4 cycles followed by Osemertinib for lung carcinoma. Meanwhile, in view of Stage I, Grade I endometroid carcinoma she will be followed up every 3 monthly for first two years, then every 6 months for three years, thereafter annually.

Discussion

Metachronous primary malignancies are becoming increasingly common because of an increase in the number of elderly populations, greater awareness, and improved diagnostic modalities. In comparison, synchronous tumors occur uncommonly, with the most common site for synchronously existing multiple tumors being the breast.[5] If initial primary is the breast, the percentage of patients expected to develop multiple primaries is 10% and for the lung it is 4%.[6] Liu et al. reported that the most common tumors accompanying lung cancer were in the aerodigestive tract (in descending order of frequency): larynx, nasopharynx, esophagus, oral cavity, hypopharynx, followed by colorectal and cervical malignancies.[7]

Whether the second lesion is truly a primary or represents metastases is difficult to decide and for this the Warren and Gates criteria (1932) are used which proposed that a diagnosis of multiple primary malignancies requires the following2: (1) each tumor should present a definite picture of malignancy; (2) each tumor should be histologically distinct; (3) the possibility that one is a metastasis of the other must be excluded. Though the mechanism involved in the development of multiple primary cancer has not been clarified, some factors such as heredity, constitution, environmental and immunological factors, carcinogenic, viruses, radiological and chemical treatments have been implicated.[8,9]

The outcome of management of patients with dual malignancies should be determined independently based upon the stage of each cancer.[10] The choice of treatment should depend upon the tumor location, involved curative surgical resection of each cancer, radiotherapy and chemotherapy. If surgery is required for both the tumors, it can be done so simultaneously in a majority of cases with low rate of morbidity and mortality as done in our case.[11]

Differential diagnosis for the patient in our case included lung metastases from the endometrium primary or vice versa. Lung metastases from endometrial neoplasms are very common, accounting for about 20-25% of all endometrial malignancies.[12,13] Double primary cancer is a more reasonable diagnosis in this case since the histopathology and immunohistochemistry of the endometrium was an endometroid carcinoma and that of the lung mass was adenocarcinoma thus ruling out any possibility of metastasis from one site to the other. This assumption is also in agreement with the North American Association of Central Cancer Registries (NAACCR) definition that "multiple lesions of different histologic types occurring in different sites are considered as separate primaries whether occurring simultaneously or at different times".[14]

Conclusion

Multiple primary malignancies seem to be diagnosed in a higher incidence than that predicted due to the increase in life expectancy of general population—a boon of advancements in cancer therapeutics— and to the more comprehensive screening protocols used in cancer patients. The study of this case can provide useful information regarding the development of effective screening and surveillance protocols, with the goal to treat patients effectively.

In conclusion, this case highlights the fact that the presence of a lesion anatomically away from the primary malignancy should be labelled as a metastasis only after detailed evaluation; otherwise, there is a possibility of missing a synchronous primary malignancy and possible effective management of the patient.

In our case, patient was planned for hysteroscopy followed by dilatation and currettage but as a part of her pre-operative workup her chest x-ray revealed an incidental finding of nodular lesion in left lungs. Hence, this case highlights a thorough pre-operative work

up of any patient undergoing surgery. Microscopic findings and immunohistochemistry proved us that we were dealing with two primary cancers and further helped us in its effective management. Both the primary cancers were in Stage I early grade. Thus, operating the patient simultaneously saved the patient from having any adjuvant therapy.

This case also highlights that proper workup of a patient is essential in managing the disease. Otherwise, we would have labelled her a case of Stage IV carcinoma endometrium and managed her accordingly. But, careful preoperative workup and immunohistochemistry helped in diagnosing this case as a synchronous primary malignancies. As a result we could provide appropriate and timely surgical management to the patient.

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Instruction to Authors

The Journal of Indian Society of Perinatology and Reproductive Biology which is the official publication of the Indian Society of Perinatology and Reproductive Biology (ISOPARB) invites original research articles in gynaecology / obstetrics / related subjects in the following category: Clinical Articles; Review Articles; and Brief Communications (including Case Reports).

All manuscripts should be prepared according to the guidelines detailed below. It is also available in our website www.ijoparb.co.in. Any manuscript that has not been formatted as per the ISOPARB requirements will be returned to the author for correction. All manuscripts should be created and submitted in Word format.

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Please submit a cover letter to the Editor-in-Chief mentioning the following:

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Once submitted, manuscripts undergo initial screening by the editorial staff and editors and then papers will undergo peer review.

2. Authors must give a separate "Author Guarantee" document mentioning the following:

(1) that all authors have met the criteria for authorship and have participated sufficiently in the work to take responsibility for it;

(2) that all authors have reviewed the final version of the manuscript and approve it for submission to the ISOPARB journal.

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(6) that the corresponding author affirms the manuscript to be an honest and transparent account of the study being reported.

In line with ICMJE standards, the criteria for authorship are as follows:

(1) Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND

(2) Drafting the work or revising it critically for important intellectual content; AND

(3) Final approval of the version to be published; AND

(4) Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Clinical trials

Submission of clinical trials must include reference to ethics approval (or explanation of why ethics approval was not received). Authors must consult the CONSORT statement and checklist and submit a CONSORT flow chart as an editable figure in Word/PowerPoi ntformat.

The clinical trial registration is preferable and information should be included at the end of the abstract of the submitted manuscript.

Review articles

Reviews based on the recent and relevant subjects of clinical interest should be considered.

4. LAYOUT OF MANUSCRIPTS

Manuscript text should be in English (US spelling), double-spaced, font size 12, in Arialmmes New Roman font.

First page

The first page of the manuscript should contain the following: (1) title; (2) full names of authors (6 maximum, although listing more authors may be considered on an individual basis if authorship requirements have been met and a request has been included in the cover letter); (3) affiliations of authors (i.e. department, section or unit of

an institution, hospital or organization, city, and country (4) full contact details (postal address. email address) of the corresponding author; (5) a list of up to 8 keywords for indexing and retrieval:

Footnotes linking author names to affiliations should be listed as 1,2,3 etc..

The first page should also list the type of article: Clinical Article; Brief Communication: or Review Article.

Abstract

Clinical Articles

A structured abstract not exceeding 200 words is required for all full-length clinical articles. It should contain all and only the following headings: Objective; Methods; Results; and Conclusion.

The Objective reflects the purpose of the study: that is, the hypothesis that is being tested. The Methods should include the setting for the study, the participants (number and type), the treatment or intervention, and the type of statistical analysis. The Results include the outcome of the study and statistical significance, if appropriate. The Conclusion states the significance of the results.

Review articles

An abstract not exceeding 200 words is required for all review articles.

Narrative reviews require an unstructured abstract. Systematic review articles should have a structured abstract with the headings; Background; Objectives; Search strategy; Selection criteria; Data collection and analysis; Main results; and Conclusions.

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Brief communications should not include an abstract.

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In full-length articles, subject matter should be organized under the following headings, with no subheadings: Introduction; Materials and methods; Results; Discussion; Acknowl edgments; Conflicts of interest; and References.

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The main text of clinical articles should not exceed 2500 words, excluding the first-page information, abstract (no more than 200 words), author contributions, acknowledgments, Conflicts of interest, references (no more than 15), figure legends, and tables and figures. Please include the word count in the cover letter and on the first page of the manuscript.

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Review articles should have no more than 3000-3500 words in the main text and 20 references. Please include the word count in the cover letter and on the first page of the manuscript.

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Brief communications should be no more than 400 words, excluding the first-page information, synopsis, keywords, author contributions, acknowledgments, conflicts of interest, references, figure legends, and tables and figures. There should be no more than 4 references and no more than 1table or 1figure.

Power calculations, statistics, and reporting of numbers.

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Where appropriate (e.g. for clinical trials), power calculations should be performed as part of the study design, and a statement providing the power of the study should be included in the Materials and Methods. Authors should state how the power calculation was determined, including what type of difference the calculation was powered to detect and on what studies the numbers are based.

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P values should be provided where calculated. The largest P value that should be expressed is P>0.99. The smallest P value that should be expressed is P<0.001.

For measures of effect (e.g. relative risks, risk ratios, odds ratios), authors should also report confidence intervals (e.g. 95%) so that the precision of the effect estimate can be assessed.

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Studies of patients, patient records, or volunteers require Ethics Committee approval and informed consent.

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Include a statement in the methods that the research protocol was approved by the relevant Institutional Review Board or Ethics Committee before the study began; if such approval was not needed/obtained, include an explanation. Authors must provide copies of the appropriate documentation if requested.

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Sources of funding should be acknowledged by the author(s), along with the names of individuals who do not fulfil the criteria for authorshi p, but who have made a substantial contribution to the manuscript.

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A conflict-of-interest statement must be included in the cover letter and before the reference list in the manuscript. It should list any relationships (for any author) that may be deemed to Influence the objectivity of the paper and its review, or state that no such relationships exist. Commercial associations, either directly or through immediate family, in areas such as expert testimony, consulting, honoraria, stock holdings, equity interest, ownership, patent-licensing situations or employment that might pose a Conflicts of interest should be stated. Conflicts for other reasons, such as personal relationships or academic competition, should also be stated.

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The number of references should not exceed 15 for clinical articles, 20 for review articles, and 4 for brief communications; in general, they should be limited to the past decade. They must be numbered and listed as they are cited in the article, using Index Medicus abbreviations for journal titles. Cite the names of all authors when there are six or fewer; when there are seven or more, list the first three authors followed by "et al." Include the volume number.

Journal article

[1] Vellacott ID, Cooke EJ, James CE. Nausea and vomiting in early pregnancy. Int J Gynecol Obstet. 1988;27:57-59.

Book

[2] Speroff L, Glass BH, Kase NG. Clinical Gynecologic Endocrinology and Infertility. Baltimore: Williams and Wilkins; 1982.

Chapter in a book

[3] Disaia PJ, Creasman WT. Invasive Cancer of the Vulva. In: Disaia PJ, Creasman WT, eds. Clinical Gynecologic Oncology. St Louis: C.V. Mosby; 1984:214-219.

Web reference

[4] World Health Organization. WHO Recommended Surveillance Standards, Second Edition [WHO website). 1999. http://www.who.int/csr/resources/publications/surveillance/whocdscsrisr992.pdf.

Text references can be indicated by Arabic numerals in superscript. abc[1]

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Each table should be titled, numbered (with Arabic numerals), and placed on a separate page after the reference list (not embedded within the main text).

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