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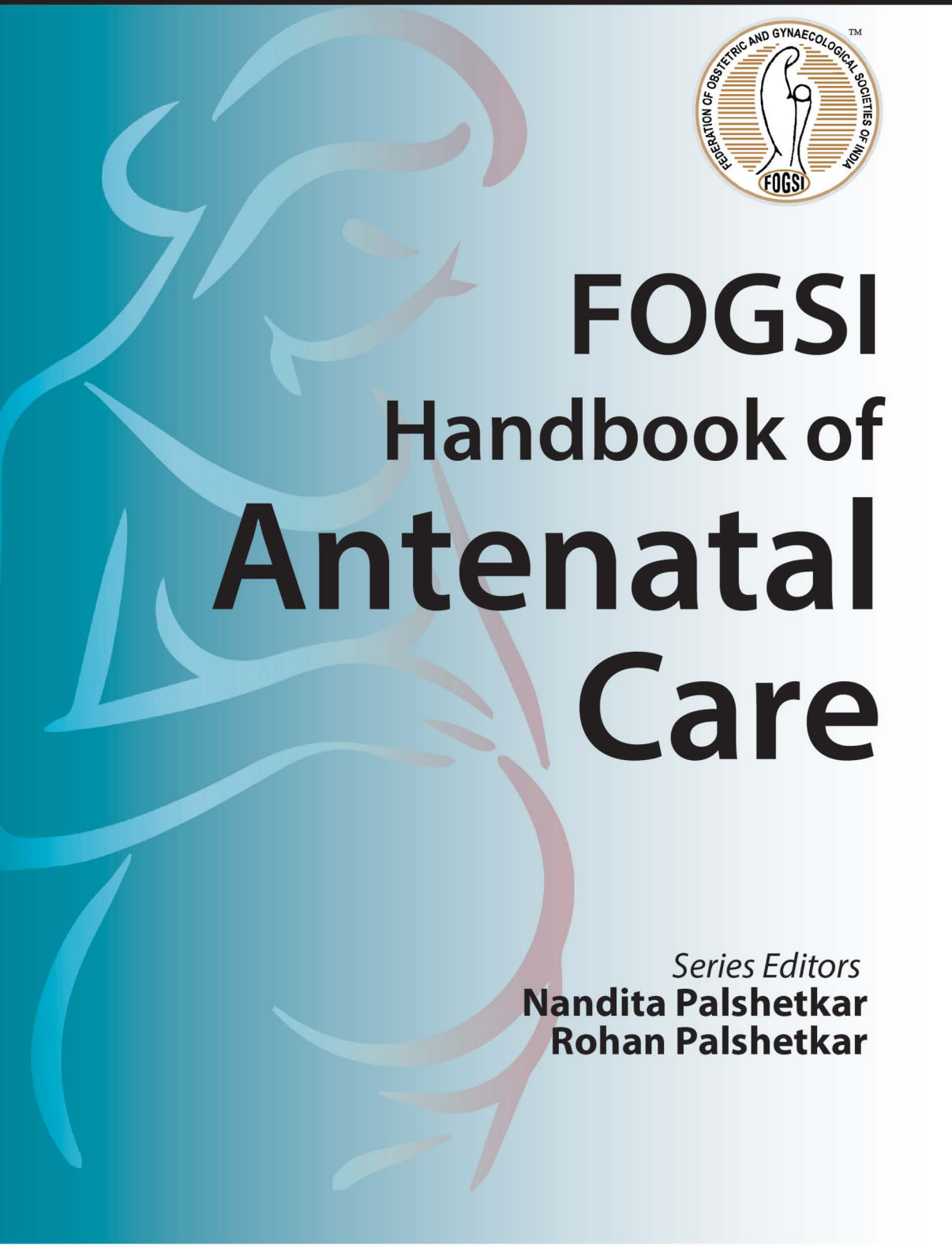

FOGSI Handbook of Antenatal Care

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Foreword
CN Purandare

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CHAPTER 3

Changing Pyramid of Antenatal Care

Monika Gupta, Monu Singh

INTRODUCTION

Antenatal care (ANC) is an essential part of maternal healthcare services. It comprises history taking, screening for maternal illnesses such as hypertensive disorders and anemia, screening, prevention and management of infectious diseases, provision of prophylactic medication and essential health education.[1] ANC has been considered essential for identification and early management of high-risk pregnancies as a means to improve pregnancy outcomes, which later was argued to have little predictive value for reduction of maternal mortality.[2-4] Global attention therefore shifted to emergency obstetric care and skilled care at birth as essential strategies to reduce maternal deaths.[5,6] Currently, however, it is globally accepted that while ANC alone is not sufficient to reduce morbidity and mortality, it remains an essential component in improving maternal and newborn health and well-being.[7,8]

EFFECTIVENESS OF ANTENATAL CARE

A number of studies have been conducted to identify essential interventions and required number of visits for ANC for establishing the evidence of effectiveness of ANC services.

Historically, the traditional ANC service model was developed in the early 1900s. This model assumes that frequent visits and classifying pregnant women into low and high risk by predicting the complications ahead of time are the best way to care for the mother and the fetus. The traditional approach was replaced by *focused antenatal care (FANC)*—a goal-oriented ANC approach, which was recommended by researchers in 2001 and adopted by the World Health Organization (WHO) in 2002.[9]

The FANC, as proposed by WHO, recommended a minimum of four visits for low-risk pregnancies with targeted interventions in each visit. FANC was meant to increase the quality of ANC and to ensure a positive pregnancy outcome. A reduction of the number of visits with targeted interventions in each visit to identify diseases and high-risk factors proved to be equally effective as monthly ANC visits.[10] One of the drawbacks of FANC was that the model was not tested in settings with low coverage of ANC visits and

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high-mortality ratios.[11] Recently, concerns have been raised that a reduced number of visits are associated with an increase in perinatal mortality.[12]

Current evidence shows that the FANC model is probably associated with more perinatal deaths than models that comprise at least eight ANC visits. Furthermore, literature suggests that more ANC visits, irrespective of the resource setting, are probably associated with greater maternal satisfaction than less ANC visits.

Consequently, the WHO updated their ANC guideline in 2016 aiming to provide women with a positive pregnancy experience and included a recommendation of a minimum of eight contacts.[13] The Guideline Development Group reviewed how ANC should be delivered in terms of both the timing and content of each of the ANC contacts, and arrived at a new model—the 2016 WHO ANC model, which replaces the previous four-visit focused ANC model.[14]

INVERTED PYRAMID OF ANTENATAL CARE: A NEW CONCEPT (FIGS. 1 AND 2)

Traditionally, it has always been believed that most of the problems and life-threatening complications develop during later half of the pregnancy and that is the reason why most of the ANC schedules have increased number of visits during second half of pregnancy. The frequency of visits increases with advancing gestation, reaching to weekly visits from 36 weeks onward. But recently, more importance is being given to maternal and fetal investigations during first trimester of pregnancy.

Professor Kypros Nicolaides from UK had developed a new concept of ANC, which focused on the very early weeks of pregnancy to identify

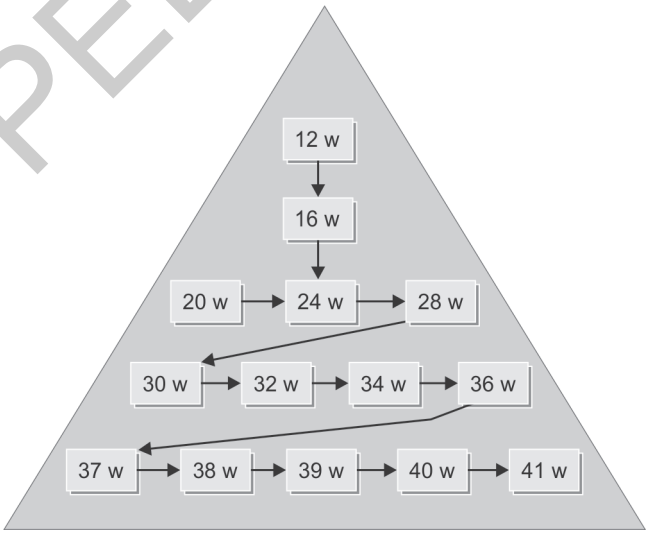

Fig. 1: Traditional pyramid of antenatal care.

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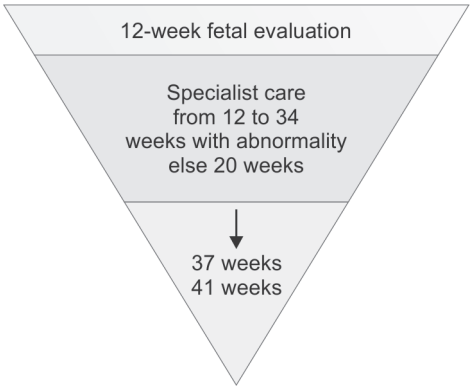

Fig. 2: Newer model of inverted pyramid of antenatal care.[16]
[*Source*: Adapted from Nicolaides KH. Turning the pyramid of prenatal care. Fetal Diagn Ther. 2011;29(3):183-96].

high-risk pregnancies.[15] According to this concept, a prenatal care plan can be developed that is suited to individual patients, by selecting pregnancies that are at the highest risk for complications, which become apparent only later in gestation and by identifying those that are at very low risk.

This inverted pyramid of care enables a much more patient and disease-specific approach of ANC.[16] The women who are identified to be at low risk in the beginning of pregnancy do not need such frequent and specialized ANC.

Thus, it was considered worthwhile to increase the focus of clinical evaluations in early pregnancy, thus, inverting the pyramid of prenatal care. The possibility of early identification of risk factors and detection of complications at 11–13 weeks of pregnancy enables effective treatment or even prevention of a disease.

This was possible due to increased use of ultrasound in the first trimester, which has revealed that many fetal structural problems can already be accurately diagnosed at this point.[17] Maternal serum biochemical screening in first trimester has also gained a lot of importance. Its use has now been expanded from screening of aneuploidies to predict pregnancy complications that become apparent only later on in pregnancy, such as pre-eclampsia (PE) and severe intrauterine growth restriction.[18]

Some very important complications that occur later in pregnancy can be predicted in the first trimester; therefore, it is worthwhile to increase the focus of clinical evaluations in early pregnancy, thus, inverting the pyramid of prenatal care.[19]

IMPORTANCE OF FIRST TRIMESTER SCREENING

The benefit of first trimester screening and diagnosis of fetal anomalies is that parents become aware of these conditions early in pregnancy when they can make their decisions in the greatest degree of privacy and when the treatment or termination is the least expensive and most safe, and also has

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minimal bearing on the emotional and mental health of the mother. This is also the ideal time for multidisciplinary care providers to intervene with health promotion activities and establish a baseline understanding of the pregnant woman's pre-existing health conditions.[15,20,21]

Fetal Aneuploidy Screening

First trimester screening helps in the diagnosis of fetal aneuploidy by combined screening [maternal age, history, gestational age, nuchal translucency (NT) measurement, and PAPP-A]. The detection rate of major aneuploidies is close to 99.3%, with a false positive rate of 0.11%, using certain maternal characteristics such as previous reproductive history, first trimester screening for aneuploidy, increased NT, the abnormal ductus venosus flow and low level of pregnancy associated plasma protein-A (PAPP-A).[22,23]

Screening the combined test can identify more than 90% of fetuses with trisomy 21. The detection rate of trisomies 18 and 13 is about 95% for the same false-positive rate.[24] The effectiveness of the first trimester combined screen can be further augmented by the addition of other biochemical markers, such as placental growth factor (PGF) and maternal serum α-fetoprotein and fetal markers such as nasal bone evaluation and Doppler evaluations of the ductus venosus and blood flow across the tricuspid valve.[24,25]

These additional ultrasound markers can be either obtained at the time of the combined screen or on a contingent basis. The contingent protocol acts on patients is divided into three categories based on the traditional combined screen—high risk (1:50), intermediate risk (1:51–1:1,000), and low risk (1:1,000). Patients in the high-risk category are offered an invasive procedure, and those in the low-risk category are reassured. Patients in the intermediate category then undergo stage-2 screening using the additional ultrasound markers. If the final risk assessment in this group is 1:100 or greater, an invasive test is offered. Those whose risk is less than 1:100 are reassured. The screening performance of both approaches is similar; the detection rate is approximately 93–96% for a 2.5% false-positive rate.[26]

Detection of Congenital Structural Defects

Even in absence of aneuploidy, it has been proven that an increased NT can be associated with a large variety of genetic syndromes and structural defects, such as diaphragmatic hernia, omphalocele, cleft lip/palate, skeletal defects, congenital adrenal hyperplasia, fetal akinesia deformation sequence, Noonan's syndrome, Smith–Lemli–Opitz syndrome, and spinal muscular atrophy.[27]

This risk increases significantly for fetuses with NT greater than 3.5 mm and reaching up to 50% for fetuses with an NT of 6.5 mm or greater. The overall detection rates of fetal anomalies in the first trimester can be as high as 51% and even higher (62–65%) in cases where both transabdominal and transvaginal ultrasound are used in cases with a thickened NT.[28]

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As regards the open neural defects, the detection of anencephaly and spina bifida can be carried out in the first trimester itself by examination and measurements of intracranial translucency and the size of the brainstem in the sagittal section.[21]

Other markers that may prove helpful in detection of open neural tube defects are narrowing of the frontomaxillary angle, biparietal diameter (BPD) measurement less than the fifth percentile, or a small BPD to transabdominal diameter ratio.[29-31]

Markers such as tricuspid regurgitation (TR) and a reversed flow in the ductus venosus in first trimester screening have proved beneficial in predicting major fetal congenital heart defects. A combination of three markers (NT > 99th percentile, TR, and abnormal a-wave in ductus venosus) can result in a detection rate of 52% for congenital heart diseases.[32]

ASSESSMENT OF MULTIPLE GESTATIONS

First trimester screening is helpful in assessment of multiple gestations, detection of chorionicity and prediction of future complications. This allows accurate counseling regarding the risk involved in the pregnancy.

Also, it has been proposed that a significant difference between the NT measurements of the two fetuses in monochorionic twins or the presence of ductus venosus blood flow abnormalities may point toward an increased risk for Twin-to-twin transfusion syndrome.[33]

First trimester ultrasound evaluation in multiple gestations has especially gained importance, as the incidence of twins has increased significantly in the past few decades.

Prediction of other Fetomaternal Complications

The placental architecture and blood flow are well established by the end of first trimester and no further changes occur after 4th month, so complications like fetal growth restriction and PE arising out of poor placentation can be well predicted in advance and treatment and close follow-up can be instituted early. This is important because any treatment to be effective in reducing the risk of complications related to placental dysfunction must be started early in pregnancy before the complete placentation occurs.

Other additional markers, which have been recently extensively studied to predict PE, are—estimation of downstream resistance by measuring the pulsatility index (PI) in the uterine arteries Doppler, maternal blood pressure measurement in the late first trimester, and evaluation of certain placental product levels in maternal serum such as PAPP-A and PGF.[34]

Detection of early PE can be approximately 90% based only on historical factors, maternal blood pressure measurement, and uterine artery PI. The addition of biochemical markers such as PAPP-A and PGF levels increases the detection rates to 96%.[35]

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Other Screening Protocols

Combination of markers such as serum PAPP-A, free beta human chorionic gonadotropin (β-hCG), PGF, placental protein 13 (PP13), and a disintegrin and metalloproteinase 12 (ADAM12) along with maternal characteristics can largely identify approximately small for gestational age fetuses, which required to be delivered before term.[36]

Cervical length measured transvaginally in combination with maternal characteristics can prove to be important in identifying high-risk group for preterm delivery that may benefit from close follow-up and possible treatment.[37]

Maternal serum biochemical markers such as adiponectin, sex hormone-binding globulin, and visfatin in combination with maternal characteristics can identify 75% of high-risk pregnancies to develop gestational diabetes mellitus.[38]

Also, increased values of NT measurement, levels of maternal serum free β-hCG and PAPP-A, and a decreased level of adiponectin can largely predict large for gestational age/macrosomic fetuses.[39]

CONCLUSION

A more intensive approach in the first trimester itself can be beneficial to detect future maternal and fetal complications and institute early treatment. Hence, an inverted pyramid of ANC was proposed to promote the intensified approach in first trimester.

The importance of ANC cannot be underestimated, it is important to reduce not only maternal mortality but also perinatal mortality. ANC coverage has been used globally to assess the efficiency of various maternal health programs. According to the WHO updated guidelines 2016, it has been changed to a minimum of eight contacts with the pregnant mother starting as early as 8–12 weeks. Emphasis should be laid on the initiation of ANC in the first trimester, which is also referred to as early ANC.

A greater emphasis should be on prevention, early identification, and timely interventions rather than dealing with complications. This philosophy has driven most advances in ANC.

Also, ANC should incorporate health promotion, prevention, screening, and detection of diseases. It should be more of a public health approach with involvement of the community itself. Early pregnancy evaluation not only benefits patients but also investment in data collection and improvement of data collection methods will help to implement a responsible public health policy.

FUTURE ASPECTS

With the advancement in medical science, the more appropriate approach would be an extended inverted pyramid for better results in perinatal medicine.[40]

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The interventions focusing on the preconception and perimplantation periods are to be researched upon. The therapy can be envisaged to be applied at subcellular and genetic level by applying the latest biotechnological procedures.

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FOGSI Handbook of Antenatal Care

The book is a must book for postgraduates to keep themselves abreast with the latest advances in obstetrics and gynecology. Recent guidelines have been discussed. The chapters have been carefully selected in accordance with latest international proceedings. The language is simple, easy-to-understand and concise advances. The authors are very experienced and they gave penned down their experience of years. It is a handy book which should find place in all libraries and bags of students. It will be a great help to practicing obstetricians and busy practitioners.

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