

International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

Neonatal Outcomes of IVF and ICSI Conceived Pregnancies and the Burden of Multifetal Gestation: A Prospective Cohort Study

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OPEN ACCESS

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Received: 04-05-2026
Accepted: 28-05-2026
Available online: 30-06-2026

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ABSTRACT

Background: Multifetal gestation remains an important mediator of prematurity and low birth weight after assisted reproductive technology (ART). Prospective neonatal outcome data from western Rajasthan are limited.
Methods: Thirty pregnancies conceived through higher ART and resulting in 42 fetuses/neonates were followed prospectively at a tertiary referral hospital. The observed cohort contained IVF (n=17) and ICSI (n=13) pregnancies; no GIFT/ZIFT cases occurred. Plurality, gestational age, birth weight, five-minute Apgar score and NICU admission were described. Apgar and NICU denominators were 41 because one pregnancy ended in intrauterine fetal death.
Results: Eighteen pregnancies (60.0%) were singleton and 12 (40.0%) twin, including 9 dichorionic diamniotic and 3 monochorionic diamniotic pairs. Twenty-one pregnancies (70.0%) delivered preterm. Among 42 fetuses/neonates, 1 (2.4%) had extremely low, 3 (7.1%) very low, 27 (64.3%) low and 11 (26.2%) normal birth weight; mean birth weight was 2.14 ± 0.57 kg. Among 41 neonates with post-birth assessment, 25 (61.0%) had five-minute Apgar 7–10, 15 (36.6%) had 4–6 and 1 (2.4%) had 0–3. Eighteen of 41 (43.9%) required NICU admission.
Conclusion: The cohort had a substantial twin burden accompanied by high overall frequencies of prematurity, low birth weight and NICU use. Because neonatal outcomes were not cross-tabulated by plurality, an independent twin effect cannot be estimated. Prevention of avoidable multifetal gestation and delivery where neonatal support is available remain priorities.

Keywords: assisted reproductive technology; neonatal outcome; twin pregnancy; low birth weight; preterm birth.

INTRODUCTION

The expansion of IVF and ICSI has transformed infertility care, but perinatal safety remains central to counselling and treatment policy. Assisted Reproductive Technology (ART)-conceived infants are born to a heterogeneous population in whom maternal age, infertility diagnosis, ovarian stimulation, embryo culture and transfer strategy may all influence outcome.[1] Even singleton IVF/ICSI pregnancies have shown higher risks of preterm birth and low birth weight in systematic reviews, although infertility-related and treatment-related mechanisms are difficult to separate.[2-5]

Multiple-pregnancy is the clearest modifiable pathway to adverse neonatal outcome after ART. Twin gestation shortens pregnancy and increases low birth weight, neonatal respiratory morbidity and intensive-care use.[6-17] A meta-analysis of ART multiples also confirmed higher risks of preterm delivery, very low birth weight, NICU admission and perinatal mortality.[18] Contemporary embryo-transfer guidance therefore aims to maximise cumulative live birth while reducing multiple gestation, particularly through careful limits on the number of embryos transferred.[19]

Prospective outcome data from Indian public-sector tertiary hospitals are valuable because such centres often receive patients after fertility treatment elsewhere, including late referrals with established complications. We described plurality, gestational age, birth-weight distribution, five-minute Apgar category and NICU admission among fetuses and neonates

delivered after IVF or ICSI conception at a tertiary centre in western Rajasthan. The analysis deliberately separates pregnancy-level and neonate-level denominators.

OBJECTIVE

To describe neonatal outcomes following IVF- and ICSI-conceived pregnancies and quantify the burden of singleton and twin gestation in a prospective tertiary-centre cohort.

MATERIALS AND METHODS

This prospective observational cohort study was conducted in the Department of Obstetrics and Gynaecology, Umaid Hospital, Dr.S.N. Medical College, Jodhpur, a tertiary referral centre in western Rajasthan. Recruitment was started after institutional ethics approval and continued until the prespecified sample of 30 women was attained. Reporting was planned in accordance with the STROBE statement.[20]

Women with primary or secondary infertility who conceived through a higher assisted reproductive technique, were booked after the first trimester or presented late in pregnancy, and could be followed through delivery were eligible. Conceptions following oral ovulation induction alone or intrauterine insemination, refusal of consent and loss to follow-up were excluded. The research committee-approved protocol named IVF, ICSI, gamete intrafallopian transfer (GIFT) and zygote intrafallopian transfer (ZIFT); however, no GIFT or ZIFT pregnancy presented during sampling. The observed cohort therefore comprised 17 IVF and 13 ICSI pregnancies.

Consecutive eligible participants were enrolled after written informed consent. Information was recorded prospectively using a structured proforma covering sociodemographic characteristics, infertility history, ART modality, obstetric history, antenatal complications, gestational age and mode of delivery, maternal disposition and complications, and neonatal outcomes. Hypertensive disorders and gestational diabetes were diagnosed from clinical records using institutional criteria. Preterm birth was delivery before 37 completed weeks. Maternal near miss denoted a life-threatening complication requiring advanced intervention or critical care.

Neonatal variables included plurality, chorionicity of twins, birth weight, five-minute Apgar category and NICU admission. Birth weight was classified as extremely low (<1.0 kg), very low (1.0 to <1.5 kg), low (1.5 to <2.5 kg) or normal (≥2.5 kg). The Apgar score was classified as 7–10, 4–6 or 0–3. One intrauterine fetal death explains why five-minute Apgar and NICU data were available for 41 rather than all 42 delivered fetuses/neonates.

Categorical variables were summarised as counts and percentages and continuous variables as mean with standard deviation or median with interquartile range, as appropriate. Denominators are stated for neonatal outcomes. The small cohort and lack of a spontaneous-conception comparison group made the present analysis descriptive; no causal or equivalence inference was attempted. Data were coded in Microsoft Excel and analysed using IBM SPSS Statistics version 29.0, with verification in Python 3.x.

The Institutional Ethics Committee of Dr.S.N. Medical College, Jodhpur approved the study. Written informed consent was obtained, identifiers were replaced by subject codes, and the study followed the Declaration of Helsinki.[21]

RESULTS

The 30 women delivered 42 fetuses/neonates. Eighteen pregnancies (60.0%) were singleton and 12 (40.0%) twin. Of the twin pregnancies, 9 (30.0% of all pregnancies) were dichorionic diamniotic and 3 (10.0%) monochorionic diamniotic; no monochorionic monoamniotic twin pregnancy was observed. Twenty-one pregnancies (70.0%) delivered before 37 weeks, including 19 late-preterm, one very-preterm and one extremely-preterm delivery. The extremely preterm pregnancy ended in intrauterine fetal death at 24 weeks.

Mean birth weight was 2.14 ± 0.57 kg, with an interquartile range of 1.78–2.58 kg. Of 42 fetuses/neonates, 31 (73.8%) weighed below 2.5 kg when ELBW, VLBW and LBW categories were combined: 1 (2.4%) was ELBW, 3 (7.1%) VLBW and 27 (64.3%) LBW. Eleven (26.2%) weighed at least 2.5 kg.

Table 1: Pregnancy plurality and gestational age outcomes n equals 30

Outcome	n	%
Singleton pregnancy	18	60.0
Twin pregnancy overall	12	40.0
Dichorionic diamniotic twins	9	30.0
Monochorionic diamniotic twins	3	10.0
Preterm delivery <37 weeks	21	70.0
Term delivery	9	30.0

Plurality and gestational-age outcomes use pregnancies, not neonates, as denominator.

Table 2: Birth weight categories among 42 fetuses and neonates

Birth weight category	n	%
Extremely low birth weight <1.0 kg	1	2.4
Very low birth weight 1.0 to <1.5 kg	3	7.1
Low birth weight 1.5 to <2.5 kg	27	64.3
Normal birth weight ≥2.5 kg	11	26.2

Combined birth weight below 2.5 kg: 31/42 (73.8%).

Five-minute Apgar and NICU outcomes were available for 41 liveborn neonates. Twenty-five (61.0%) had Apgar scores of 7–10, 15 (36.6%) had scores of 4–6 and 1 (2.4%) had a score of 0–3. Eighteen neonates required NICU admission (43.9%).

Table 3: Five minute Apgar score and NICU admission among 41 liveborn neonates

Outcome	n	%
Apgar 7–10	25	61.0
Apgar 4–6	15	36.6
Apgar 0–3	1	2.4
NICU admission	18	43.9
No NICU admission	23	56.1

One intrauterine fetal death was excluded from Apgar and NICU denominators. Percentages may not total exactly 100 because of rounding.

DISCUSSION

This cohort demonstrates three clinically relevant features: a 40% twin-pregnancy rate, preterm delivery in 70% of pregnancies, and birth weight below 2.5 kg in nearly three quarters of fetuses/neonates. More than two in five liveborn neonates required NICU admission. These findings describe a high-risk tertiary-referral population rather than the expected outcome of every IVF or ICSI conception.

The high twin burden provides an important context for interpreting prematurity and low birth weight. ART multiples consistently have poorer gestational-age and birth-weight outcomes than ART singletons,[18] and comparisons of IVF/ICSI multiples with singletons show greater NICU use and neonatal mortality. The correct interpretation is that a substantial, biologically relevant exposure and adverse aggregate outcomes coexisted in the cohort.

Low birth weight was the dominant neonatal finding. The combined proportion below 2.5 kg was 73.8%, while 9.5% were below 1.5 kg. Systematic reviews of singleton IVF/ICSI pregnancies have found higher risks of low and very low birth weight than spontaneous conception,[2,3] and earlier meta-analysis similarly reported adverse perinatal outcomes among IVF singletons.[4] Potential explanations include placental dysfunction, parental infertility characteristics and aspects of treatment, but residual confounding is substantial.[5] In this cohort, the concurrent 70% preterm-delivery rate probably explains much of the birth-weight distribution.

Most liveborn neonates had a five-minute Apgar score of 7–10, yet 39.0% had a score below 7 and 43.9% required NICU admission. Prematurity and low-birth-weight were the leading clinical indications recorded for intensive care, with respiratory distress also noted. These observations support planned delivery in facilities with skilled neonatal resuscitation, thermoregulation, feeding support and respiratory care. They also illustrate why accurate denominators matter: birth weight applied to 42 fetuses/neonates, whereas Apgar and NICU outcomes applied to 41 liveborn neonates after exclusion of one intrauterine death.

Reducing avoidable multiple gestation remains the most direct preventive strategy. Embryo-transfer policies that prioritise singleton birth can lower twin-related morbidity without treating the success of a single transfer as the only outcome; cumulative live birth across a treatment course is the more appropriate counselling frame.[19] Decisions should account for age, embryo stage and quality, previous cycles and patient preferences, with transparent discussion of the maternal and neonatal consequences of twins.

Strengths and Limitations

Strengths include prospective follow-up through delivery, explicit reporting of chorionicity, neonatal denominators, and NICU percentage. Limitations are the small sample size, single-centre referral setting, absence of a spontaneous-conception control group; and lack of data on transfer number, embryo stage, fresh versus frozen transfer, and neonatal diagnoses or duration of NICU stay. Patient-level cross-tabulations by plurality (singleton versus twin pregnancy), and adjustment for gestational age or chorionicity should be worked-up to calculate a twin-versus-singleton risk ratio or claim that twins independently caused the observed neonatal morbidity. Neonates from twin pregnancies are also clustered within mothers; future analyses should use methods that account for this non-independence.

CONCLUSION

In this prospective cohort of IVF- and ICSI-conceived pregnancies, twin gestation was common and aggregate rates of preterm delivery, low birth weight and NICU admission were high. The data support measures to minimise avoidable multifetal gestation and coordinated antenatal and neonatal planning. A larger patient-level study with plurality-specific outcomes and clustered statistical analysis is needed to quantify the independent effect of twin gestation.

ACKNOWLEDGEMENT

The authors thank the faculty and staff of the Department of Obstetrics and Gynaecology, Umaid Hospital and Dr.S.N. Medical College, Jodhpur; and all women and families who participated in the study. The authors gratefully acknowledge Dr Shailendra Vashistha and the VAssist Research team (www.thevassist.com) for assistance with scientific manuscript preparation and submission support.

CONFLICT OF INTEREST: None declared.
SOURCE OF FUNDING: Nil.

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