

Ultrasound Guided Embryo Reduction in a Fertility Center in Nepal: An Observational Study

Sanu Maiya Shrestha Pradhan¹, Renee Pradhan¹, Paban Sharma²

Abstract

Background and Aims: The chances of multiple pregnancy rate increases in Assisted Reproductive Technology (ART) treatment. Different techniques have been developed to reduce high order multiple gestation to improve perinatal outcome. The current study aims to assess the pregnancy outcome following embryo reduction

Methods: This was a retrospective observational study conducted from August 2018 till February 2021 at Creator's IVF Nepal Pvt. Ltd. In this study, 22 cases were enrolled with high order multifetal gestation that included quadruplets and triplets. All women had conceived by ART by Intrauterine Insemination (IUI) or In Vitro Fertilization (IVF). Embryo reduction was done either by transvaginal or by transabdominal ultrasound guidance.

Results: In total 22 cases underwent embryo reduction (ER), of which 15 (68.18%) by transvaginal and 7 (31.8 %) by transabdominal approach. Among them one had undergone IUI and the rest had IVF. Mean age of women was 32.36 ± 5.34 years. Out of 22 cases, 16 (72.72 %) delivered at mean gestational age 34.75 ± 1.84 weeks. There were 4 (18.18 %) miscarriages. Two cases are awaiting delivery. Out of sixteen deliveries there was one triplet, eleven twins and four singleton deliveries. Majority of them underwent cesarean deliveries.

Conclusions: Multifetal pregnancy can cause different obstetric complications. Women had better perinatal outcome with ultrasound guided ER. However, majority of women had to undergo cesarean deliveries.

Keywords: Artificial Reproductive Technology (ART); In Vitro Fertilization (IVF); Embryo Reduction (ER).

Introduction

The incidence of multifetal pregnancies has increased over the past few years. This is mainly as a result of widespread use of ovulation induction agents and Artificial Reproductive Technology (ART).¹ Although not all multifetal pregnancies occur after the use of ART, fertility treatments have contributed significantly to the dramatic increase in multifetal pregnancies.² High order multiple gestations have increased risk of fetal and maternal complications.³ The risk adds on with the additional number of fetus.³ In order to reduce the incidence of preterm delivery, perinatal morbidity and to improve the neonatal survival in multifetal pregnancies, Multifetal Pregnancy Reduction (MFPR) is offered to the patients.⁴ MFPR has been safe and is considered an effective treatment for reducing the number of pregnancies. This reduces both perinatal morbidity and mortality in the resultant pregnancies.⁵ Hence, techniques for fetal reduction have emerged as an effective approach to improve the perinatal outcome. Ultrasound guided fetal reduction is safe and effective method for reduction of

multifetal gestation. Transvaginal Embryo Reduction (TVS ER) and Transabdominal Embryo Reduction (TAS ER) are the two multifetal reduction methods performed under ultrasound guidance.⁴ TVS ER is performed between 7 and 8 weeks of gestation and TAS ER is conducted after 11 weeks of gestation.⁴

In lower and middle income countries (LMICs) such as Nepal, the evidence on ART in general and specifically on embryo reduction (ER) remains scant. This study aims to assess the pregnancy outcomes following the ER procedures among the women from one of the fertility centers in Nepal. The findings of this study could provide a baseline information and a guidance for clinical decisions for the infertility specialists from similar settings in LMICs.

Material and Methods

This is a retrospective observational study conducted from August 2018 to February 2021 over a period of 2.5 years at Creator's IVF Nepal Pvt. Ltd, Kathmandu, Nepal. In this study, all 22 women with high order multifetal gestation

1. Creator's IVF Nepal Pvt. Ltd,

2. Patan Academy of Health Sciences, Kathmandu, Nepal.

Corresponding author: Dr. Sanu Maiya Shrestha (Pradhan), Senior Consultant Gynecologist/ Obstetrician and IVF Specialist, Clinical Director Creator's IVF Nepal Pvt Ltd, Lalitpur, Nepal. Email: sanumaiya2021@gmail.com

that included quadruplets and triplets were enrolled. Of the 22 patients, two had conceived with ovulation induction followed by Intrauterine Insemination (IUI) and the rest twenty women had conceived by In vitro fertilization (IVF). The couples were explained about the potential risk of the procedure. A written informed consent was taken for the same. Fifteen women underwent embryo reduction (ER) by transvaginal ultrasound guidance at 6 to 7 weeks of gestation and in the rest seven, ultrasound guided ER was performed by transabdominal route between 11 to 12 weeks of gestation. Data was entered in Microsoft Excel and descriptive analysis was performed for the collected data using SPSS 20.

Clinical Procedure

Transvaginal ultrasound-guided embryo reduction:

The patients were asked to empty the bladder. The patients were placed in a lithotomy position. The procedures were carried out under intravenous sedation using Propofol (1%) and parts were cleaned with povidone-iodine solution. The patients received intravenous antibiotic prophylaxis (Cefotaxime 1gm). The ultrasound used was Nemio SSA-550A (Toshiba) equipped with a 7.5 MHz transvaginal transducer and a needle guide. A sterilized vaginal probe cover was used in the transducer. The uterus was scanned for the patients to identify the configuration and the position of each gestational sac with each other. The number of gestational sacs with embryo, their position, size and cardiac activity was verified. Exact alignment between the needle and the ultrasound screen guide was adjusted to perform the procedure. Under transvaginal ultrasound guidance, an oocyte retrieval needle (Follicle Puncture System Bielefeld, 17 gauge 30 cm with 1.6 mm outer diameter, Manufacturer: Reproline Medical GmbH) was introduced through the needle guide and was advanced briskly through the vaginal fornix and the uterine wall into the nearest easily accessible gestational sac. Suction pressure (400 mmHg) through suction meter (Craft Suction Unit) was applied abruptly and continuously until most of the embryonic parts as well as the amniotic fluid in the respective gestational sac were aspirated. If the location of the sacs permitted, additional sac was penetrated with the same needle without re-puncturing the vaginal mucosa and the uterine wall. The absence of embryonic cardiac pulsation was confirmed. After that, the needle was withdrawn. All the procedures were performed by the principal author (Dr. Sanu Maiya Shrestha Pradhan). Post procedure the patients were given intramuscular Progesterone injection BP (Maxesterone 200 mg) followed by oral antibiotics for 5 days. When indicated Rh negative immunoglobulin prophylaxis was given. The patients were observed closely for any evidence of vaginal bleeding, abdominal pain. The patients were discharged 4 hours post procedure and the number of remaining gestational sacs with pulsating echoes were confirmed. A follow-up ultrasound was carried out after 1 week. All patients underwent subsequent routine prenatal follow up.

Trans abdominal Ultrasound guided Embryo reduction:

The patients were asked to empty the bladder and lie

supine. Parts were painted with povidone-iodine solution. The ultrasonic probe of 3.5 MHz (Xario 100, Toshiba) was used for the fetal reduction procedure. The maternal abdomen at the site of needle insertion was infiltrated with local anesthetic agent 2 % Lidocaine (Jasocaine) HCL USP injection. With the transducer in the place, 20 gauge (0.9*90mm) disposable BD spinal needle was introduced through the maternal abdomen passing into the amniotic cavity into the thorax of one of the most accessible fetus. Utmost precaution was taken to avoid piercing through the placenta. Potassium chloride (KCl) 1-2 ml, 2meq/ml, was injected till into the fetal heart till asystole was observed for one to three minutes.

Post procedure the patient was given intramuscular Progesterone injection BP (Maxesterone 200 mg) followed by oral antibiotics for 5 days. Patients were observed closely for any sign of vaginal bleeding, abdominal pain or uterine contractions. Discharge advice was same as for patients who underwent reduction through transvaginal route.

Results

Table 1 shows the general and clinical characteristics of the women who underwent embryo reduction. In total 22 women with high order multifetal pregnancy were enrolled for the study. The mean duration of infertility in the women seeking ART treatment was 5.45 ± 3.78 years. There were more cases of primary infertility (n=14, 63.64%) than secondary infertility (n=8, 36.36%). Among the different causes of infertility, female factor was the major cause of infertility. Among 10 (45.45 %) women who had female factor, 5 women had bilateral tubal blockage, 3 had decreased ovarian reserve due to advanced age and the remaining 2 had combination of previous two factors. The male factor was observed in 4 (18.18) women and unexplained in 8 (36.36%) as the causes of infertility. The majority of the ART cycles were IVF with self-oocyte stimulation (n=14, 63.63%), followed by IVF with donor oocyte (n=5, 22.72%). Two cycles (9.09%) were IUI with donor semen and 1 cycle was embryo donation (4.55%). Fifteen cases had fresh transfer and the five underwent frozen thaw transfer.

In all the cases, the first transvaginal sonography (TVS) was done at 5 weeks of gestation which confirmed 7 (31.82 %) quadruplets, 14(63.64 %) triplets and 1(4.55 %) twin pregnancies.

In total, 15 (68.18%) cases underwent embryo reduction by transvaginal route between 6 to 7 weeks of gestation and 7 (31.8 %) cases by transabdominal approach between 11 weeks to 12 weeks of gestation.

Table 2 demonstrates the details of the 15 cases where embryo reduction was done at 6 to 7 weeks of gestation by transvaginal ultrasound. Sn.3, quadruplet was reduced to twins following which post procedure twins pregnancy was self-reduced to single pregnancy. In Sn 9, taking into consideration the request of the patient, twin pregnancy was reduced to singleton pregnancy. In Sn15, after reduction from quadruplet pregnancy, twin pregnancy was achieved. But one twin underwent missed abortion at 12 weeks of gestation and now the woman is awaiting delivery of the

Table 1: General and Clinical Characteristics of women who underwent embryo reduction (N=22)

Characteristics	
Age in years (Mean ± SD)	32.4±5.3
Infertility Duration in years (Mean ± SD)	5.4±3.8
	Number of cycles
Type of infertility	
Primary	14 (63.63%)
Secondary	8 (36.36%)
Cause of Infertility	
Male factor	4 (18.18%)
Female factor	10 (45.45%)
Blockage of bilateral tubes	5 (22.72%)
Poor Ovarian Reserve	3 (13.63%)
Poor Ovarian Reserve and tubal factor	2 (9.09%)
Unexplained	8 (36.36%)
Treatment Protocol	
IVF (Self oocyte Stimulation)	14 (63.63%)
IVF (Donor oocyte)	5 (22.72%)
Embryo Donation	1 (4.55%)
IUI (Donor Semen)	2 (9.09%)
Multiple pregnancy prior to embryo reduction	
	Number of women
Quadruplets	7 (31.82%)
Triplets	14 (63.64)
Twins	1 (4.55%)
Method of embryo reduction	
TVS-ER	15 (68.18%)
TAS-ER	7 (31.81%)

singleton fetus.

Table 3 shows the details of 7 cases where embryo reduction was done at 11-12 weeks of gestation by transabdominal

route. In Sn3, quadruplet pregnancy was self-reduced to triplets prior to the procedure. Hence, triplet was reduced to twin. In Sn 6, triplet pregnancy was reduced to singleton

Table 2: Details of 15 cases where embryo reduction was done at 6 to 7 weeks of gestation by transvaginal ultrasound route:

Sn	Age (years)	Method of assisted reproduction technique*	No. of embryos transferred	No. of gest sacs with embryos		Type of delivery
				Before procedure	After procedure	
1	29	LP/ICSI	3	3	2	Twins
2.	35	ICSI/OD	4	3	2	Missed abortion at 26 weeks
3.	44	OD	4	4	2	Single
4.	26	LP	5	4	2	Twins
5.	30	LP	3	3	2	Twins
6.	36	LP/ICSI	4	4	2	Twins
7.	26	LP/ICSI	4	3	2	Missed abortion at 14 weeks
8.	45	ED	4	4	2	Twins
9.	31	IUI D		2	1	Single
10.	30	LP	3	3	2	Twins
11.	29	IUI D		3	2	Twins
12.	27	LP/ICSI	3	3	2	Missed abortion at 14 weeks
13.	30	LP	3	3	2	Twins
14.	34	OD	3	3	2	Awaiting delivery of twin
15.	34	LP	5	4	2	Awaiting delivery of single fetus

*LP= Long protocol, OD=Oocyte donation, ICSI=Intracytoplasmic Sperm Injection, ED=Embryo donation, IUI D= Intrauterine Insemination Donor

on patient's request.

Figure 1 shows the graph representing pregnancy type after USG (Ultrasonography) guided embryo reduction. Among all 22 cases, triplet to twin reduction was highest accounting to 59.09 % among all, which is followed by quadruplets to twin (27.27 %) as illustrated in Figure 1. Post embryo reduction, there was one triplet, nineteen twins and two singleton pregnancies.

Figure 2 represents the graph representing the number of attempts for TVS-ER and TAS-ER. All the embryo reduction done by transvaginal route was done successfully in single

attempt. Two embryo reductions done by transabdominal ultrasound guidance had to undergo multiple attempts whereas rest five was completed in a single session. Figure 2 represents the mentioned data.

Figure 3 represents the delivery outcomes of the women. A total of sixteen deliveries were recorded until the time of data collection. The delivery outcomes include 1 triplet delivery, 11 set of twins, and 4 singleton deliveries. There were 4 (18.18 %) cases of miscarriages, 3 abortions in first trimester and 1 in second trimester. The mean gestational age when the abortion occurred was of 19.5 ± 6.4 weeks.

Table 3: Details of 7 cases where embryo reduction was done at 11-12 weeks of gestation by transabdominal ultrasound route

Sn	Age (years)	Method of assisted reproduction technique*	No. of embryos transferred	No. gestational sacs with embryos		Type of delivery
				Before procedure	After procedure	
1.	41	OD	5	3	2	Twin
2	32	SP	5	4	3	Triplet
3	33	ED	4	4	2	Twin
4	27	LP	3	3	2	Missed abortion at 24 weeks
5	31	LP	4	3	2	Single
6	34	LP	4	3	1	Single
7	28	LP	4	3	2	Twin

*OD=Oocyte donation, SP=Short protocol, ED=Embryo donation, LP= Long protocol

Table 4 shows the perinatal outcomes of the 15 patients in the same serial order as in Table 2 which showed the embryo reduction was done by Transvaginal ultrasound route. The mean gestational age of delivery was calculated to be 34.75 ± 1.84 weeks. One delivered normally at term and the rest nineteen women underwent cesarean deliveries. Nine cases had emergency Lower Segment Cesarean Section (LSCS) for different obstetric indications like preeclampsia, Premature rupture of membrane (PROM), antepartum hemorrhage (APH) with placenta previa, AND fetal distress. Six elective LSCS were conducted of which 4 were term LSCS and 11 were preterm LSCS. Except 2 awaiting cases, 3 had abortion. The rest had delivered via LSCS of which 6 had undergone emergency LSCS. Among the ones who delivered, majority had the birth weight above 2 kg. Whereas one women who underwent emergency LSCS for fetal distress at 32 weeks of gestation had neonatal death. A woman who had emergency LSCS due to premature rupture of membrane at 34 weeks of gestation delivered the twins with 1.8 kg birth weight each.

Table 5 shows the perinatal outcomes of 7 patients in the same serial order as in Table 3 which showed the embryo reduction done by trans abdominal ultrasound route. Only one delivery was uneventful and underwent elective LSCS. The others had obstetric indications for PROM, Pre-eclampsia, pre-term labor, and APH/ placenta previa. As given in table 5, in Sn5, in twin pregnancy, in one twin pleural effusion was detected in the ultrasonography and underwent fetal demise at 20 weeks of gestation.

Figure 4 shows the birth outcomes of the babies delivered. In total 29 babies were delivered and there was one NND. The babies delivered at term didn't require NICU (Neonatal Intensive Care Unit) admission. The preterm delivered babies were admitted in NICU for few days. None of them had prolonged NICU stay. All 28 babies are in stable condition till date.

Discussion

The incidence of multiple gestations has drastically increased due to the use of different fertility drugs and ART. The obstetric complications associated with multiple gestations can be very serious. Multiple embryo transfer which attributes for multifetal gestation is thought to be necessary for increasing the chance of pregnancy.⁶ Multiple gestations are responsible for increasing maternal and neonatal morbidity and mortality. The maternal complications associated with multiple gestations are preeclampsia, gestational diabetes, preterm labor and preterm delivery.⁷ Patients with high-order multiple gestations must choose one of three options: 1) continuing the pregnancy and accepting all of the risks; 2) terminating the pregnancy; 3) MFPR to reduce the number of fetuses and hence minimizing the associated risks.⁷ Hence, in order to improve the perinatal outcome, ultrasound guided embryo reduction appears to be a convincing solution.

Our study shows the mean age of women who have conceived by ART was 32.36 ± 5.34 years. Similar studies done by Lee et al⁸, Mansour et al⁹ and Iberico et al¹⁰, ABF Mohammed et al³ reported the mean age of their study population to be 30.6 ± 2.9 years, 32.4 ± 3.5 years, 33 ± 4.5 years, 34 ± 2.2 years respectively.

One of the concerning complications of ultrasound guided embryo reduction is miscarriage. The rate of miscarriage after embryo reduction varies between 4% to 33%.¹¹ The study by Gunasheela et al reported 17.9 % miscarriage rate which is similar to the result obtained in our study.¹² Hartoov et al in his study found that the overall pregnancy loss rate was 12%.¹³ Rest of the other studies, Mansour et al and Iberico et al showed lesser rate of miscarriage.^{9,10}

Embryo reduction by transvaginal route with OPU needle followed by aspiration of the embryonic parts was done till fetal cardiac asystole. Use of injection KCL was

Figure 1: Graph representing pregnancy type after USG guided embryo reduction (N=22)

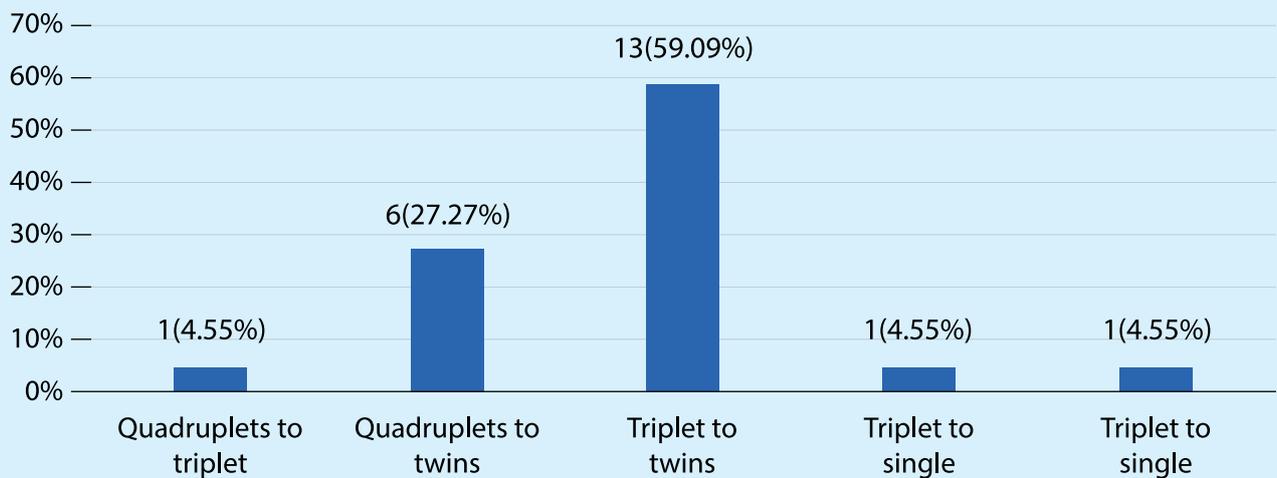


Figure 2: Number of attempts for TVS-ER and TAS-ER (N=22)

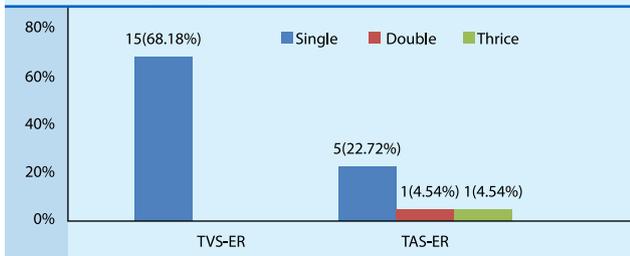


Figure 3: Delivery outcomes of women (N=22)

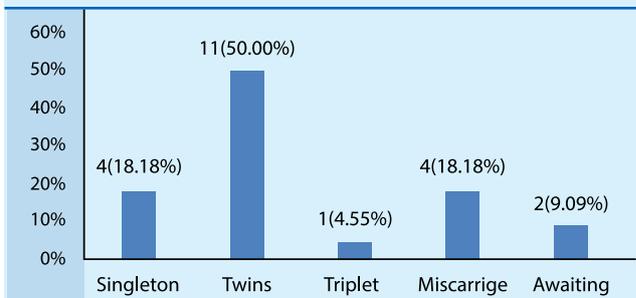


Table 4: Perinatal outcome of 15 patients in the same serial order as in Table 2. (Embryo reduction was done by Transvaginal ultrasound route.)

SN	ANC period	Pregnancy outcome	Birth Weight
1.	Pre-eclampsia	Em [§] LSCS [#] at 34 weeks	2.1 kg, 1.65 kg
2.	Missed abortion at 26 weeks	-	-
3.	Uneventful	Term LSCS [#]	3.2kg
4.	PPROM*	Em [§] LSCS [#] at 35 weeks	2.3 kg, 2.9 kg
5.	Uneventful	Term LSCS [#]	2 kg, 2.1 kg
6.	Preterm labor	Em [§] LSCS [#] at 35 weeks	2.3 kg, 2 kg
7.	Missed abortion at 14 weeks	-	-
8.	PPROM*	Em [§] LSCS [#] at 35 weeks	2.75 kg, 2 kg
9.	Uneventful	SVD ^α at term	3.5 kg
10.	Fetal distress	Em [§] LSCS [#] at 32 weeks	1.6 kg, 800 gms(NND)
11.	Uneventful	Term LSCS [#]	2.5 kg, 2.1 kg
12.	Missed abortion at 14 weeks	-	-
13.	PPROM*	Em [§] LSCS [#] at 34 weeks	1.8 kg, 1.8 kg
14.	Uneventful	Awaiting delivery	-
15.	Missed abortion of 1 twin at 12 weeks	Awaiting delivery	-

*PPROM= Pre term Premature Rupture of Membrane; §Em= Emergency; # LSCS= Lower Segment Caesarean Section, αSVD= Spontaneous Vaginal Delivery

avoided in our study when the procedure was performed by transvaginal approach. Similar approach without the use of KCL was undertaken in the study by Gunasheela et al.¹² All procedures were successfully completed in single attempt when the procedure was carried out through transvaginal route. In study by Iberico et al, all procedures were also completed in single attempt.¹⁰ Dey M et al in his study had done all embryo reductions by transabdominal approach using KCL.¹⁴ This is in favorable comparison

with our study where we have used KCL in all the seven trans-abdominal guided embryo reduction.

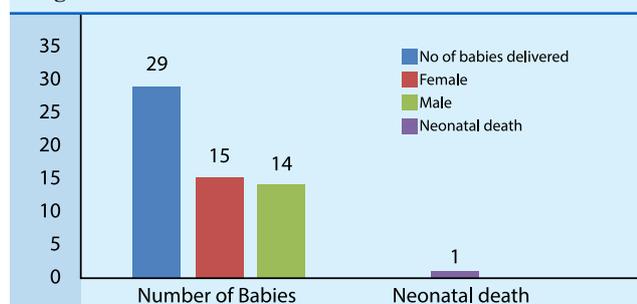
In our study none of the women had post procedure infection or spotting. Similar results were obtained in the study done by Pankaj et al.¹¹ In the study of Youssef et al, spotting occurred in 10 % cases and was self-limited in the following week with rest without affecting the outcome of pregnancy³. There was no reported postoperative infection. The incidence of low rate of post procedural infection can

Table 5: Perinatal outcome of 7 patients in the same serial order as in Table 3. (Embryo reduction was done by Transabdominal ultrasound route)

SN	ANC period	Pregnancy outcome	Birth Weight of each baby
1.	PPROM [§]	Em ^α LSCS ^β at 32 weeks	1.8 kg, 1.4 kg
2.	Preeclampsia	Em ^α LSCS ^β at 33 weeks	1.2kg, 1.3 kg, 1.5 kg
3.	Uneventful	EI [#] LSCS ^β at 36 weeks	3.5 kg, 2.8 kg
4.	Missed abortion at 24 wks	-	-
5.	2 nd Twin abortion at 20 weeks due to pleural effusion	EI [#] LSCS ^β at 37 weeks (repeat LSCS)	2.35 kg
6.	Preterm labor with APH*	Em ^α LSCS ^β at 35 weeks	1.5 kg
7.	APH* / Placenta previa	EI [#] LSCS ^β at 36 weeks	2.5kg, 2 kg

§PPROM=Pre Term Premature Rupture of Membrane, *APH=antepartum hemorrhage; αEm= Emergency; #EI= Elective

Figure 4: Birth outcomes of the deliveries



be explained by minimal manipulations which is been followed in our study. These results are also comparable to that reported by Iberico et al.¹⁰

The number of embryos to be reduced is always a matter of debate. Most studies advocated reduction to twins.¹⁵ Early embryo reduction has the advantage that the placenta and the embryo that need to be absorbed are smaller.¹⁶ This version holds truth with our study where we have done transvaginal embryo reduction between 6 to 7 weeks. The incidence of different obstetric complications like preeclampsia, ante partum hemorrhage (APH), preterm threatened labor (PTL) are more in triplets rather than in twins. As study done by Joseph M. et al, the decision on where and which embryo undergoes reduction is technical and is done according to anatomic considerations.¹⁶

In our study the percentage of triplet to twin reduction

was 59.09% and from quadruplets to twin's reduction was 27.25%. A study by Iberico et al recommended embryo reduction to twin pregnancy since the obstetric risk are acceptable.¹⁰ This result is compatible with ours where most of the high order pregnancies were reduced to twin gestation for improved maternal and neonatal outcome.

In our study, out of total sixteen deliveries, one patient had full term normal delivery and the rest fifteen had cesarean delivery summing the cesarean rate to 93.75%. Hence, caesarean rate was higher due to different indications like malpresentation, prematurity, preeclampsia, PPROM with unfavorable cervix. Hence, cesarean section was significantly higher in multifetal reduction procedure.¹⁷ In our study, only one (7.25%) woman delivered vaginally at term. However, in studies done by Hartoov et al¹³, Dey M et al¹⁴ and ABF Mohammed et al³, the vaginal delivery rate was 57%, 30% and 29.4% respectively. While comparing with the mentioned studies, our study revealed a significant decrease in rate of vaginal delivery.

The Live Birth Rate (LBR) achieved in our study was 80 % which can be accredited to be a significant improved perinatal outcome. On the contrary, Lee et reported only LBR only 69.7%⁸, Iberico et al reported to have the highest LBR.¹⁰

Stone J et al, studied 1000 cases of multifetal reduction and concluded that there was a significant trend towards increment of the mean gestational age at delivery and the birth weight being greater when pregnancy reduction was

done to a single rather than twins.¹⁸ Meta-analysis by Zipori et al showed embryo reduction of triplet gestation to twins resulted in comparable perinatal outcome.⁸

One neonatal death (NND) in a set of twin delivery was reported in our study. The twin which was lost in seven days of life had weighed only 800 grams at the time of birth. Similarly, Youssef et al and Mohammed et al reported two cases of NND in their study.^{3,19}

There is always a challenge in preventing the occurrence of multiple pregnancies in a woman undergoing infertility treatment. The ACOG (American College of Obstetricians and Gynecologists) committee on the ethics asserts that “first approach to the problem of multiple gestations should be prevention”. Options need to be explored in developing ways to judge which embryo would have a higher chance of implanting so fewer embryos would need to be transferred per cycle.

Our study contains relatively small number of cases. Hence, no definite conclusion can be drawn. A large prospective study need to be undertaken to validate the results. Multifetal pregnancy reduction raises considerable ethical and religious debates. It is a difficult situation for both the doctor and the couple.

Conclusion

Embryo reduction improves the perinatal outcome in high order multifetal pregnancy. Although the complications associated with the procedure cannot be avoided. The transvaginal ultrasound guided techniques or the transabdominal technique offers a salvage option for the management and prevention of the medical and obstetric complications associated with multifetal gestation resulting from ART treatment.

Acknowledgments: The authors thank all members of Creator’s IVF Nepal Pvt. Ltd that includes management team, embryology department, nursing department and medical record keeping department.

Source of Fund: Nil

Conflict of Interest: None

How to cite this article: Pradhan SSM, Pradhan R, Sharma P. Ultrasound Guided Embryo Reduction in a Fertility Center in Nepal: An Observational Study. *Bangladesh J Fertil Steril*; 2021;1(2): 93-101

References

1. Haas J, Hourvitz A, Dor J, Yinon Y, Elizur S, Mazaki-Tovi S, et al. Pregnancy outcome of early multifetal pregnancy reduction: triplets to twins versus triplets to singletons. *Reprod Biomed Online*. 2014 Dec;29(6):717–21.
2. Committee Opinion No. 719 Summary: Multifetal Pregnancy Reduction. *Obstetrics & Gynecology* [Internet]. 2017;130(3). Available from: <https://journals.lww.com/greenjournal/Fulltext/2017/09000/>

- Committee Opinion No __719_Summary__ Multifetal.41.aspx
3. Mohammed ABF, Farid I, Ahmed B, Ghany EA. Obstetric and neonatal outcome of multifetal pregnancy reduction. *Middle East Fertility Society Journal*. 2015 Sep;20(3):176–81.
4. Kim MS, Choi DH, Kwon H, Ahn E, Cho HY, Baek MJ, et al. Procedural and obstetric outcomes after embryo reduction vs fetal reduction in multifetal pregnancy. *Ultrasound Obstet Gynecol*. 2019 Feb;53(2):214–8.
5. Evans M, Littman L, Richter R, Richter K, Hume R. Selective reduction for multifetal pregnancy. Early opinions revisited. *The Journal of reproductive medicine*. 1997 Dec;42(12):771–7.
6. Pennings G. Avoiding multiple pregnancies in ART: multiple pregnancies: a test case for the moral quality of medically assisted reproduction. *Hum Reprod*. 2000 Dec;15(12):2466–9.
7. Multiple gestation associated with infertility therapy: an American Society for Reproductive Medicine Practice Committee opinion. *Fertility and Sterility*. 2012 Apr;97(4):825–34.
8. Lee JR, Ku S-Y, Jee BC, Suh CS, Kim KC, Kim SH. Pregnancy Outcomes of Different Methods for Multifetal Pregnancy Reduction: A Comparative Study. *J Korean Med Sci*. 2008 Feb;23(1):111–6.
9. Mansour RT, Aboulghar MA, Serour GI, Sattar MA, Kamal A, Amin YM. Multifetal pregnancy reduction: modification of the technique and analysis of the outcome. *Fertil Steril*. 1999 Feb;71(2):380–4.
10. Ibérico G, Navarro J, Blasco L, Simón C, Pellicer A, Remohí J. Embryo reduction of multifetal pregnancies following assisted reproduction treatment: a modification of the transvaginal ultrasound-guided technique. *Hum Reprod*. 2000 Oct;15(10):2228–33.
11. Talwar P, Sharma R, Sandeep K, Sareen S, Duggal B. Embryo reduction: our experience. *Med J Armed Forces India*. 2011 Jul;67(3):241–4.
12. Gunasheela D, Rao S, Jain G, Gs A. Outcomes of transvaginal multifetal pregnancy reduction without injecting potassium chloride. *Int J Reprod Contracept Obstet Gynecol*. 2016 Dec 20;6(1):182.
13. Hartoov J, Geva E, Wolman I, Lerner-Geva L, Lessing JB, Amster R, et al. A 3 year, prospectively-designed study of late selective multifetal pregnancy reduction. *Hum Reprod*. 1998 Jul;13(7):1996–8.
14. Dey M, Saraswat M. Outcomes of Multifetal Reduction: A Hospital-Based Study. *J Obstet Gynaecol India*. 2018 Aug;68(4):264–9.
15. Boulot P, Vignal J, Vergnes C, Dechaud H, Faure JM, Hedon B. Multifetal reduction of triplets to twins: a prospective comparison of pregnancy outcome. *Hum Reprod*. 2000 Jul;15(7):1619–23.
16. Brandes JM, Itskovitz J, Timor-Tritsch IE, Drugan A, Frydman R. Reduction of the number of embryos in a multiple pregnancy: quintuplet to triplet. *Fertil Steril*. 1987 Aug;48(2):326–7.
17. Zipori Y, Haas J, Berger H, Barzilay E. Multifetal pregnancy reduction of triplets to twins compared with non-reduced triplets: a meta-analysis. *Reprod Biomed Online*. 2017 Sep;35(3):296–304.

18. Stone J, Ferrara L, Kamrath J, Getrajdman J, Berkowitz R, Moshier E, et al. Contemporary outcomes with the latest 1000 cases of multifetal pregnancy reduction (MPR). *American Journal of Obstetrics and Gynecology*. 2008 Oct 1;199(4):406.e1-406.e4.
19. Youssef H, Fawky E, Goda H, Elshafei M. Pregnancy outcome after multifetal reduction via early transvaginal embryo aspiration: Mansoura fertility care unit experience. 2007;12(3):6.