

# Obstetrical and Neonatal Outcomes of Embryo Reduction to Twins (ERTT) Procedures in Triplet and Higher Order Pregnancies: A Cross-Sectional Study

Ayman Dawood\*, Mohamed Elnamoury, Walid Atallah

Department of Obstetrics and Gynecology, Tanta University, Tanta, Egypt



## Article Info

[10.30699/jogcr.7.2.99](https://doi.org/10.30699/jogcr.7.2.99)

**Received:** 2021/06/26;

**Accepted:** 2021/08/01;

**Published Online:** 25 Oc 2021;

Use your device to scan and read the article online



## Corresponding Information:

**Ayman Dawood,**  
Department of Obstetrics and Gynecology,  
Tanta University, Tanta, Egypt  
**Email:** [ayman.dawood@med.tanta.edu.eg](mailto:ayman.dawood@med.tanta.edu.eg)

## ABSTRACT

**Background & Objective:** Multifetal reduction not only lowers the number of fetuses but also improves pregnancy outcomes. A great conflict emerges when obstetrician faces triplet or higher order multifetal pregnancies. Decision-making is so difficult whether to continue pregnancy as such with its risks or reduce the number of fetuses to improve outcomes. This study aimed to assess the obstetrical outcomes of Embryo Reduction to Twins (ERTT) procedures in IVF/ICSI centers in Egypt.

**Materials & Methods:** This retrospective cross-sectional study was conducted from June 2017 to December 2020. Data of the patients in five IVF/ICSI centers were accessed using the computer-stored patients' files. Patients who got pregnant spontaneously or after IVF/ICSI procedures with 3 or more embryos were recruited in the study. The patients were counseled for ERTT and those who accepted the procedure were included. The measured obstetrical outcomes were abortion rate, preterm labor, and preeclampsia, premature rupture of membranes, and neonatal morbidity and mortality.

**Results:** One hundred and twenty four cases were included in this study from 5 IVF/ICSI centers. Most cases (83.87%) of multifetal pregnancies were due to IVF/ICSI procedures. The mean age was  $28.3 \pm 2.5$  years and the mean gestational age at reduction was  $8.4 \pm 0.6$  weeks. The great majority of cases (72.58%) were operated by aspiration. The abortion rate was 29.84%. The mean gestation age at delivery was  $34.51 \pm 1.82$  weeks. The incubator admission rate was 41.93% and the overall postoperative complication was 9.68%.

**Conclusion:** Embryo Reduction to Twins in triplets or higher order pregnancies was considered feasible, safe and linked to minimal complications. The ERTT procedure improved obstetrical and neonatal outcomes.

**Keywords:** Embryo reduction, Multiple pregnancy, Neonatal morbidity, Obstetrical outcomes, Triplets



Copyright © 2022, This is an original open-access article distributed under the terms of the Creative Commons Attribution-noncommercial 4.0 International License, which permits copy and redistribution of the material just in noncommercial usages with proper citation.

## Introduction

Nowadays, assisted reproductive technologies increased the incidence of triplet and higher order pregnancies. These techniques eventually have led to an increase in the incidence of miscarriages, preterm labor, subsequent prematurity, and its health and economic burdens. A recent study showed that fetal loss occurs commonly before 24 weeks and that early preterm delivery occurs before 32 weeks and these complications are among the commonest complications of triplet pregnancies (1).

Several procedures and drugs were investigated to reduce the risks associated with triplets and higher order pregnancies, including progesterone supplementation, cerclage, combined cerclage and progesterone, and embryo reduction (ER). A recent

study showed that ER in higher order pregnancies is a safe and preferred approach in reducing morbidity and mortality (2).

Although multifetal pregnancy reduction is considered a safe and effective technique in reducing perinatal complications, it is difficult for couples to accept such an approach. ER procedure is associated with emotional pain, stress, fear, and sensation of guilt in the 2/3 of cases that underwent this procedure. Therefore, adequate counseling is necessary before undertaking this procedure (3,4).

Literature review revealed contradictory results where some studies advocated ER and some did not. In this study, the obstetrical and neonatal outcomes of ERTT in multifetal pregnancies were investigated.

## Materials and Methods

### Study Design and Settings

This retrospective cross-sectional multi-center study was conducted at five IVF/ICSI centers in Egypt. The centers included were the Fertility Unit of Tanta Educational Hospital, Egyptian Consultant Center, Quret Ain Fertility Center, Engab Fertility Center, and Om Elqura Fertility Center. The study was conducted from June 1, 2017, to December 31, 2020.

### Patients

The files of the patients who were pregnant with 3 or more embryos were reviewed. The patients who accepted ERTT were included in the study either pregnancy was spontaneous or through IVF/ICSI.

### Collected Data

All data including the patients' age, gravidity, parity, infertility type and duration, origin of multiple pregnancies, gestational age at reduction, abortion rate, incidence of preterm labor, preeclampsia, premature rupture of membranes (PROM) and other adverse outcomes, the gestational age at delivery, and neonatal morbidity or mortality were recorded.

### Statistical Methods

The data were analyzed using SPSS version 20 (SPSS Inc., Chicago, IL., USA). The statistical procedures were descriptive statistical tests, including mean, standard deviation and percentage.

## Results

One hundred and eighty six files of triplets and higher order pregnancies were evaluated. From them, 124 patients who underwent ERTT procedures were included in this study.

The demographic data of enrolled patients are presented in Table 1. The mean age was  $28.3 \pm 2.5$  years, mean gravidity was  $1.80 \pm 0.34$ , and mean parity was  $1.33 \pm 0.61$ . The majority of cases [86 (69.35%)] presented with primary infertility with mean duration of infertility at  $4.77 \pm 1.20$  years. The great majority of cases [104 (83.87%)] resulted from IVF/ICSI procedures, while 15 cases (12.10%) resulted from ovulation induction and 5 cases (4.03%) occurred spontaneously.

The procedure of embryo reduction to twins (ERTT) has been explained in Table 2. The mean gestational age at reduction was  $8.4 \pm 0.6$  weeks. The most commonly used method was embryo aspiration which was used in 90 cases (72.58%) and the remaining 34 (27.42%) were managed by fetal cardiac tapping. The mean duration of the procedure was  $26.11 \pm 5.26$  minutes. Most cases who underwent ERTT [108 (87.10%)] were triplets, while 16 cases (12.90%) were quadruplets. The procedure was linked to some complications like sub-chorionic hematoma in 6 cases (4.84%) and vaginal bleeding in 4 cases (3.23%). Two cases (1.61%) were complicated by bladder puncture by a needle. The total post-surgery complication rate was 9.68%.

Obstetrical outcomes are shown in Table 3. The total abortion rate was 37/124 (29.84%) and most cases aborted between 20-28 weeks. Regarding the timing of delivery, most cases (60.48%) delivered prematurely while only 9.68% delivered at full term with mean gestational age of  $34.51 \pm 1.82$  weeks at delivery. The other obstetrical outcomes such as preeclampsia (16.93%), PROM (28.23%) and antepartum hemorrhage (21.77%) also occurred. The majority of cases were delivered by cesarean section (61.29%). Neonatal outcomes are also presented in Table 3, where the mean birth weight, incubation admission rate, and mortality rate were  $1645.87 \pm 130.21$  gr, 41.93% and 10.48%, respectively.

**Table 1.** Demographic data of enrolled patients (n=124)

Parameter	Range	Mean±SD
Age (years)	24-35	28.3±2.5
Gravidity	0-4	1.80±0.34
Parity	0-3	1.33±0.61
<b>Type of infertility (n, %)</b>		
Primary	86	69.35%
Secondary	38	30.65%
<b>Duration of infertility (years)</b>		
	Range	Mean±SD
	2-10	4.77±1.20
<b>Origin of multiple pregnancy (n, %)</b>		
IVF/ICSI	104	83.87%
Ovulation induction	15	12.10%
Spontaneous	5	4.03%

**Table 2.** Procedures of ERTT (n=124)

Parameter	Range	Mean±SD
Gestational age at reduction (weeks)	7-12	8.4±0.6
<b>Embryo reduction method (n,%)</b>		
Embryo aspiration	90	72.58%
Embryo cardiac tapping	34	27.42%
Duration of procedure (minutes)	18-30	26.11±5.26
<b>Embryos number (n, %)</b>		
Triplets	108	87.10%
Quadruplets	16	12.90%
<b>Immediate complications (n, %)</b>		
Vaginal bleeding	4	3.23%
Sub-chorionic hematoma	6	4.84%
Bladder injury by needle	2	1.61%
Total postoperative complications	12	9.68%

**Table 3.** Obstetrical outcomes of ERTT procedures (n=124)

Parameter	Number	Percentage
<b>Abortion (n, %)</b>		
Within 2 weeks of procedure	7	5.64%
Before 20 weeks	12	9.68%
20-28 weeks	18	14.52%
Total abortion rate	37	29.84%
<b>Delivery timing (n,%)</b>		
Preterm labour	75	60.48%
Full-term delivery	12	9.68%
<b>Preeclampsia (n,%)</b>		
PROM (n,%)	35	28.23%
<b>Antepartum hemorrhage (n, %)</b>		
Placenta previa	18	14.52%
Accidental hemorrhage	9	7.25%
Total antepartum hemorrhage	27	21.77%
<b>Mode of delivery (n, %)</b>		
Vaginal	11	8.87%
Cesarean section	76	61.29%
<b>Gestational age at delivery</b>		
	Range	Mean±SD
	30-38	34.51±1.82
<b>Neonatal weight (g)</b>		
	Range	Mean±SD
	1200-2230	1645.87±130.21
Incubation admission (n, %)	52	41.93%
Neonatal mortality (n, %)	13	10.48%

## Discussion

The current study was designed to develop some information that could be helpful in counseling women with triplet or higher order pregnancies regarding fetal reduction to twins and expectant management. The current study aimed at the evaluation of fetal reduction

of triplet or higher order pregnancies to twin pregnancy and whether this would be helpful to prolong pregnancy and avoid prematurity and its perinatal complications.

In the current study, 18 pregnancies ended with abortion, which constitutes 29.84% of the cases of which 5.64% were within 2 weeks of the fetal reduction procedure, 9.68% before 20 weeks and 14.52% between 20-28 weeks. Therefore, most cases aborted between 20-28 weeks. We reported postoperative complications in 9.68% of the cases.

Our results were in agreement with the reports by Papageorgiou *et al.*, (1) and Chaveeva *et al.*, (5) that mentioned fetal loss before 24 weeks of gestation increased after fetal reduction procedures. Mandiola *et al.*, reported fetal losses after ER procedure in 14.8% and post-surgery complications in 3.7% of the cases (6). On the other hand, our results contradicted the results of Drugan *et al.* (7) and Shiva *et al.* (8) which showed that fetal loss rate before 24 weeks did not differ between reduced and nonreduced pregnancies (12.3% vs 12.1%).

Miscarriages that occurred 2 weeks after fetal reduction were due to faulty fetal reduction technique rather than resorption of the dead fetoplacental tissue. This was in agreement with the findings of Papageorgiou *et al.* (1). This is important for adequate counseling of patients in order to choose the best option of treatment. Sunol reported the loss of all embryos after the reduction procedure in 4.5% of study populations (9). This finding was not uncommon; it is comparable with triplets' spontaneous loss rate, which varies from 2.6% to 8.3% (10-12).

The mean gestational age at delivery was 34.5 weeks and the risk of delivery before 34 weeks was 52.4%. This was in concordance with Antsaklis *et al.*, who compared 185 trichorionic triplet pregnancies that were reduced to twins with 70 triplet pregnancies that were managed expectantly where the incidence of preterm delivery was 40.5% in the reduced group (13). Similarly, Papageorgiou *et al.*, found a reduction in the rate of preterm delivery (from 23.9% to 9.7%) with fetal reduction (1).

Chaveeva *et al.*, compared the outcome of fetal reduction versus expectant management (EM) in trichorionic and dichorionic triplet pregnancies and found a significant reduction in the incidence of preterm birth in trichorionic triamniotic pregnancies, which reduced to twins (20.9% versus 49.5%) than in EM (5).

In the current study, we found that the incidence of hypertensive disorders was 16.93%. This incidence was comparable to the incidence of pregnancy-related hypertensive conditions in triplet pregnancies reported in many studies (14, 15).

Day *et al.*, found in their study that hypertensive disorders in pregnancy were more common in multiple pregnancies when compared to singleton pregnancies. They found that hypertensive conditions had a greater incidence in twin, triplet, and higher order pregnancies with the following incidence rates (12.7%, 20.0%, and 19.6%, respectively), while the incidence of

hypertensive disorders with singleton pregnancies was 6.5% (14).

Chibber *et al.* found 23% incidence of preeclampsia in triplets, while it was diagnosed in 30% of higher order pregnancies ( $P < 0.05$ ). The authors reported that preeclampsia was mild and well-controlled, with no case reported with eclampsia. They concluded that preeclampsia was found in nearly similar incidence to the reported incidence in literature which was 20–39% for triplets (15).

Premature rupture of membranes occurred in 28.23% of cases included in this study. This is much lower than the incidence of PROM in the literature. In one study, ROM before 37 weeks of gestation occurred in 64% of cases (12.2% between 37 and 34 weeks, 23.5% between 34 and 28 weeks and 28.4% < 28 weeks). The incidence of PROM in triplet pregnancies was much lower in the study by Garg P. *et al.*, who studied prolonged PROM incidence in singleton and multiple pregnancies. They reported that PROM occurred in 27.9% of singleton pregnancies, 22.4% of twins and 12.8% of triplets (16, 17).

Everwijn *et al.*, studied the reduction of triplets to twins in a retrospective study. They found no difference in miscarriage < 24 and preterm labor < 32 weeks for ongoing triplets and triplets reduced to twins (3.8% vs 7.9% and 26.8% vs 22.4%, respectively). They stated no improvement in obstetrical and neonatal outcomes for triplet reduced to twins. Moreover, the risk of pregnancy loss before 24 weeks was higher in reduced twins (18).

Mandiola *et al.*, conducted 54 embryonic reductions during 2005-2006. They found that 38.9% of cases delivered prematurely < 37 week and reported high economic burdens with increased morbidity and mortality. However, they concluded that ER procedures improved perinatal outcomes compared to the gestations without reductions in reducing economic costs. They recommended doing reductions and importantly prevent their occurrence by limiting the number of transferred embryos (6).

Lee *et al.*, conducted a multi-center study in two tertiary care hospitals to study the effect of ER in improving obstetrical and neonatal outcomes in triplets. Their study enrolled 495 triplet pregnancies from 2006 to 2016. They allocated patients into either EM group (n=185) or ER group (n=310). They reported that early preterm delivery (<32 weeks) was higher in the EM group compared to the ER group [33 (18.1%) vs. 20 (6.9%); OR=2.97, 95% CI=1.64-5.36,  $P < 0.001$ ]. They concluded that EM improved fetal survival with good obstetric and neonatal care (19).

A recent meta-analysis of 24 eligible studies compared reduction to non-reduction in multifetal pregnancies. They suggested that reduction procedures were associated with good perinatal outcome (20).

Similarly, Talwar *et al.*, and Tse *et al.*, conducted their studies on 51 and 52 multifetal pregnancies resulting from IVF procedures, respectively. They aimed to prevent and manage the associated medical and obstetric risks by doing transvaginal ultrasound embryo reduction. They found ER procedures safe and effective in improving obstetrical and neonatal outcomes (21, 22).

The strengths of this study were adding to the current evidence that ERTT are safe and effective procedures in multifetal pregnancies, helping obstetricians and couples to make the right decision to continue the pregnancy with twins rather than higher order pregnancies, reducing perinatal mortality and morbidity, and economic burdens. The weak points of this study were the study's retrospective nature and the small size of included patients.

## Conclusion

Embryo reduction to twins (ERTT) procedures were safe and effective in reducing the obstetrical complications linked to triplets and higher order pregnancies. Neonatal morbidity and mortality were

minimal in ongoing pregnancies. Further randomized controlled studies are recommended to compare such procedures to conservative treatments in higher order pregnancies.

## Acknowledgments

Being a retrospective study, this study was exempt from committee approval by Tanta University ethical committee.

## Authors Contribution

Ayman Dawood: Protocol writing, collection of data, writing manuscript, revision and submission. Mohamed Elnamoury: Writing manuscript, statistical analysis, revision of the manuscript. Waleed Atallah: Writing manuscript, revision and collection of data.

## Conflict of Interest

The authors declared no conflict of interest.

## References

- Papageorghiou A, Avgidou K, Bakoulas V, Sebire N, Nicolaides KR. Risks of miscarriage and early preterm birth in trichorionic triplet pregnancies with embryo reduction versus expectant management: new data and systematic review. *Hum Reprod.* 2006, 21(7):1912-1917. [DOI:10.1093/humrep/del048] [PMID]
- Kim MS, Kang S, Na ED, Im J, Ahn E, Shin JE, et al. Obstetrical outcomes of embryo reduction and fetal reduction compared to nonreduced twin pregnancies. *Arch Gynecol Obstet.* 2019;299(4):953-60. [DOI:10.1007/s00404-019-05089-w] [PMID]
- Talwar P, Sharma RK, Sandeep K, Sareen S, Duggal BS. Embryo reduction: our experience. *Med J Armed Forces India* 2011;67(3):241-4. doi:10.1016/S0377-1237(11)60050-6 [DOI:10.1016/S0377-1237(11)60050-6]
- Lee JR, Ku SY, 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;23(1):111-6.. [DOI:10.3346/jkms.2008.23.1.111] [PMID] [PMCID]
- Chaveeva P, Kosinski P, Puglia D, Poon LC, Nicolaides KH. Trichorionic and dichorionic triplet pregnancies at 10-14 weeks: outcome after embryo reduction compared to expectant management. *Fetal Diagn Ther* 2013;34: 199-205. [DOI:10.1159/000356170] [PMID]
- Mandiola M, Carbonero JL, Gumbre A, Rodriguez L and Atutxa F. Embryo reductions carried out in the period 2005- 2006 in our assisted reproduction unit. Preliminary results, *Fertil Steril.* 2008, 90, Pages S488. [DOI:10.1016/j.fertnstert.2008.07.068]
- Drugan A, Ulanovsky I, Burke Y, Blazer S, Weissman A. Fetal reduction in triplet gestations: twins still fare better. *Isr Med Assoc J.* 2013;15(12):745-7.
- Shiva M, Mohammadi Yeganeh L, Mirzaagha E, Chehrazi M, Bagheri Lankarani N. Comparison of the outcomes between reduced and nonreduced triplet pregnancies achieved by Assisted Reproductive Technology. *Aust N Z J Obstet Gynaecol.* 2014;54(5):424-7. [DOI:10.1111/ajo.12225] [PMID]
- Sunol J. Embryo reductions in multiple pregnancies obtained with assisted reproductive technology (ART). Clinical evolution of 132 cases. *Fertil Steril.* 2008;90:S487. [DOI:10.1016/j.fertnstert.2008.07.077]

10. Berkowitz RL, Lynch L, Stone J, Alvarez M. The current status of multifetal pregnancy reduction. *Am J Obstet Gynecol* 1996;174:1265-72. [DOI:10.1016/S0002-9378(96)70669-5]
11. Evans MI, Cicorica D, Britt DW, Fletcher JC. Update on selective reduction. *Prenat Diagn* 2005;25:807-13. [DOI:10.1002/pd.1261] [PMID]
12. Manzur A, Goldsman MP, Stone SC, Frederick JL, Balmaceda JP, Asch RH. Outcome of triplet pregnancies after assisted reproductive techniques: how frequent are the vanishing embryos?. *Fertil Steril*. 1995;63(2):252-7. [DOI:10.1016/S0015-0282(16)57350-6]
13. Antsaklis A, Souka AP, Daskalakis G, Papantoniou N, Koutra P, Kavalakis Y, et al. Embryo reduction versus expectant management in triplet pregnancies. *J Matern-Fetal Neonat Med*. 2004;16(4):219-22. [DOI:10.1080/jmf.16.4.219.222]
14. Day MC, Barton JR, O'Brien JM, Istwan NB, Sibai BM. The effect of fetal number on the development of hypertensive conditions of pregnancy. *Obstet Gynecol*. 2005;106(5 Part 1):927-31. [DOI:10.1097/01.AOG.0000182578.82926.9c] [PMID]
15. Chibber R, Fouda M, Shishtawy W, Al-Dossary M, Al-Hijji J, Amen A, et al. Maternal and neonatal outcome in triplet, quadruplet and quintuplet gestations following ART: a 11-year study. *Arch Gynecol Obstet*. 2013;288(4):759-67. [DOI:10.1007/s00404-013-2796-x] [PMID]
16. Pakrashi T, Defranco EA. The relative proportion of preterm births complicated by premature rupture of membranes in multifetal gestations: a population-based study. *Am J Perinatol*. 2013; 30(1):69-74. [DOI:10.1055/s-0032-1321502] [PMID]
17. Garg P, Abdel-Latif ME, Bolisetty S, Bajuk B, Vincent T, Lui K. Perinatal characteristics and outcome of preterm singleton, twin and triplet infants in NSW and the ACT, Australia (1994–2005). *Arch Dis Childhood-Fetal Neonat Ed*. 2010;95(1):F20-4. [DOI:10.1136/adc.2009.157701] [PMID]
18. Everwijn S, van de Mheen L, Ravelli A, Knapen M, Oepkes D, Engels M, et al. 27: Outcome after embryo reduction in triplet pregnancy compared to ongoing triplet pregnancies and primary twins. *Am J Obstet Gynecol*. 2012 1;206(1):S19. [DOI:10.1016/j.ajog.2011.10.053]
19. Lee JY, Jun JK, Jeong M, Lee SM, Choi DH. 97: Obstetric and perinatal outcomes of expectant management in women with triplet pregnancy compared to embryo reduction to a twin pregnancy. *Am J Obstet Gynecol*. 2017;216 (1):S69-70. [DOI:10.1016/j.ajog.2016.11.986]
20. Zipori Y, Haas J, Berger H, Barzilay E. Multifetal pregnancy reduction of triplets to twins compared with nonreduced triplets: a meta-analysis. *Reprod Biomed Online*. 2017;35(3):296-304. [DOI:10.1016/j.rbmo.2017.05.012] [PMID]
21. Talwar P, Sharma RK, Sandeep K, Sareen S, Duggal BS. Embryo reduction: our experience. *Medical Journal Armed Forces India*. 2011 Jul 1;67(3):241-4. [DOI:10.1016/S0377-1237(11)60050-6]
22. Tse WT, Law LW, Sahota DS, Leung TY, Cheng YK. Triplet pregnancy with fetal reduction: experience in Hong Kong. *Hong Kong Med J*. 2017;23(4):326. [DOI:10.12809/hkmj176267]

#### How to Cite This Article:

Dawood A, Elnamoury M, Atallah W. Obstetrical and Neonatal Outcomes of Embryo Reduction to Twins (ERTT) Procedures in Triplet and Higher Order Pregnancies: A Cross-sectional Study. *J Obstet Gynecol Cancer Res*. 2022; 7(2):99-104.

#### Download citation:

[BibTeX](#) | [RIS](#) | [EndNote](#) | [Medlars](#) | [ProCite](#) | [Reference Manager](#) | [RefWorks](#)

#### Send citation to:

 [Mendeley](#)  [Zotero](#)  [RefWorks](#)