IJMS
Vol 50, No 10, October 2025

Original Article

Maternal and Neonatal Outcomes Following Ultrasound-Guided Microwave Ablation for Selective Fetal Reduction in Complicated Monochorionic Pregnancies: A Case Series

Homeira Vafaei[1], MD; Shohreh Roozmeh[2], MD; Alireza Shamshirsaz[3], MD; Nasrin Asadi[1], MD; Naeimehossadat Asmarian[4], PhD; Maryam Kasraeian[1], MD; Shohra Qaderi[5], MD; Khadije Bazrafshan[2], MSc; Mozhde Ghiasi[6], MSc; Azam Faraji[1], MD

[1]Maternal-fetal Medicine Research Center, Department of Obstetrics and Gynecology, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran;
[2]Maternal-fetal Medicine Research Center, Shiraz University of Medical Sciences, Shiraz, Iran;
[3]Department of Obstetrics and Gynecology, Baylor College of Medicine, Maternal Fetal Care Center, Boston Children's Hospital, Harvard Medical School, Boston, MA, United States;
[4]Anesthesiology and Critical Care Research Center, Shiraz University of Medical Sciences, Shiraz, Iran;
[5]Maternal Fetal Care Center, Division of Fetal Medicine and Surgery, Boston Children's Hospital, Harvard Medical School, Boston, MA, USA;
[6]Dr Vafaei Perinatology Center, Shiraz University of Medical Sciences, Shiraz, Iran

Correspondence:
Shohreh Roozmeh, MD;
Maternal-Fetal Medicine Research Center, Hafez Hospital, Chamran Blvd.,
Postal code:7194634786, Shiraz, Iran
Tel: +98 71 36479830
Email: dr.roozmeh1995@yahoo.com
Received: 22 July 2024
Revised: 07 November 2024
Accepted: 28 January 2025

What's Known

- Microwave ablation (MWA) is a newly introduced technique for selective fetal reduction in complicated monochorionic (MC) pregnancies.

What's New

- To describe the detailed implementation of MWA for selective fetal reduction in complicated MC pregnancies— the first such report in Iran.

Abstract

Background: Microwave ablation (MWA) is a newly introduced technique for selective fetal reduction in complicated monochorionic (MC) pregnancies. This study aimed to describe maternal and neonatal outcomes after implementing MWA for selective fetal reduction in complicated MC pregnancies and analyze the procedure's success rate.

Methods: This is a case series of 21 complicated MC pregnancies that underwent MWA in the Fetal-Maternal Center affiliated with Shiraz University of Medical Sciences (Shiraz, Iran) to occlude fetal blood circulation from May 2021 to May 2022. The participants were followed until delivery. Gestational age at the time of the procedure, duration of the procedure, survival rate, procedure-to-delivery time, gestational age at delivery, as well as maternal and neonatal outcomes were evaluated.

Results: MWA was successfully performed in all 21 cases. The median (Q1-Q3) gestational age at the time of the procedure was 18 weeks. The fetus's blood circulation was completely stopped in all cases. The median (Q1-Q3) total ablation time was 4 (3-6) min, and the total ablation voltage was 100 (100-200) W. Fetal loss occurred in 19% (4/21) of cases after MWA. The duration of the surgery showed a significant negative correlation with the surgical outcome (P=0.012). The overall procedure-to-delivery time was 16 (14.5-19.5) weeks, with a survival rate of 81%. The median gestational age at delivery was 34 (30.5-37.5) weeks. Among the babies, 70.6% required admission to the neonatal intensive care unit; however, all survived the neonatal period. No maternal complications were observed.

Conclusion: MWA represents a potentially effective alternative modality for selective fetal reduction in complicated MC twin pregnancies. As a newly introduced technique, it is still in its early stages of implementation, and there is a need for reporting and discussing the specific details of its application.

The abstract of this article was presented at the International Fetal Medicine Foundation Congress in the Emirates (28-29 September 2024).

Please cite this article as: Vafaei H, Roozmeh S, Shamshirsaz AR, Asadi N, Asmarian NS, Kasraeian M, Qaderi S, Bazrafshan K, Ghiasi M, Faraji A. Maternal and Neonatal Outcomes Following Ultrasound-Guided Microwave Ablation for Selective Fetal Reduction in Complicated Monochorionic Pregnancies: A Case Series. Iran J Med Sci. 2025;50(10):713-721. doi: 10.30476/ijms.2025.103408.3667.

Keywords ● Selective fetal termination ● Complicated monochorionic pregnancy ● Microwave ablation

As we know, the microwave makes an ellipsoid-like coagulation area around the active point of the needle. Consequently, to create a 15 mm ablation zone in the inradius around the intra-abdominal portion of the umbilical cord, MWA should be performed at 100-150 W for 3 min in one or two cycles based on the manufacturer's recommendation. Consequently, we changed our method. Surprisingly, by changing our method, 15 out of 16 cases survived. This means that by modifying the procedure, the survival rate increased (from 40% to 93.8%).

Stephenson and the others used the same energy with 100-140 W net power at the applicator end for 3 min in their MWA of the TRAP Sequence method.[4] Our procedure was in agreement with their methods, regarding net power, voltage, and procedure duration.

In our study, the median time spent on MWA of the affected fetuses was significantly higher in the first five cases than in the rest of the cases. Among surviving co-twins, the median gestational age at delivery was 34 (30.5-37.5) weeks with a mean of 32±7.47 weeks and an overall survival rate of 81%.

In a recent study conducted in Iran by Rahimi and others on 143 complicated MC cases undergoing RFA, the overall survival rate in co-twins was 71.3%, and the mean GA at delivery was 34.6±3.3 weeks.[13]

Another study by Meng and others on 45 complicated MC pregnancies who underwent MWA for selective fetal reduction found that the overall survival rate was 73.3%, with the median GA at delivery of 37.6 weeks.[7]

The total ablation time in the present study was 5.61±4.4 min, which was shorter than the actual energy application time of 8.5±4.2, reported by Meng and others.[7]

The present study showed an 11.8% rate of PTD before 32 weeks of gestation, compared to the 9% rate reported by Meng and others.[7] The overall procedure-to-delivery interval in our series was 16.70±2.86 weeks, which was longer than the 13.6 weeks reported by Meng and others.[7]

In our series, none of the fetuses exhibited cerebral injuries 6-8 weeks post-procedure, with all demonstrating normal fetal brain structures on brain MRI. Unlike RF ablation cases where thermal injury to co-twins has been reported (due to direct needle contact),[14] this complication was less likely in MWA, as the cooling antenna of the microwave machine had no direct contact with the co-twin.

To date, several studies have reported the use of MWA in managing complicated MC pregnancies.[4, 8, 15] All of these studies consistently concluded that MWA represents the most straightforward method for intra-fetal vessel ablation. Its advantages, including controlled coagulation zone size with minimal adjacent tissue damage and rapid creation of a larger thermocoagulation zone, establish its superiority over RF or bipolar coagulation techniques.[6, 16] As a relatively novel technique still in its early stages of clinical application, comprehensive reporting and discussion of procedural details remain essential. The present study provided a detailed method of applying MWA in the selective reduction of complicated MC pregnancies, aiming to establish optimal implementation practices.

However, the present study had several limitations. The main limitation was the small sample size; larger cohorts would yield more precise results. Long-term neuroimaging and neurological outcomes of surviving fetuses are the main issues in all prenatal fetal interventions. Although this study included thorough data collection and analysis, the absence of a control group might affect the generalizability of the findings. Future research should prioritize randomized controlled trials with larger samples, focusing on both the method of application and long-term neonatal outcomes to fully elucidate this method's potential challenges.

Conclusion

MWA represents a potentially effective, safer, and faster alternative for selective fetal reduction in complicated MC twin pregnancies. However, as a newly introduced technique, it is still in its early stages of implementation. Thus, there is a need for reporting and discussing the specific details of its application and implementation.

Acknowledgement

The authors would like to thank Shiraz University of Medical Sciences (Shiraz, Iran) and the Center for Development of Clinical Research at Nemazee Hospital for their support.

Authors' Contribution

H.V: Conceptualization, design, and critical reviwing; Sh.R: Conceptualization, design, and critical reviwing; A.Sh: Study design, drafting, and critical reviwing; N.A: Study design, drafting, and critical reviwing; NS.A: Data analysis and critical reviwing; M.K: Study design, drafting, and critical reviwing; Sh.Q: Study design, drafting, and critical reviwing; Kh.B: Data analysis and critical reviwing; M.Gh: Study design, drafting,