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In utero transfer - maternity ward of Virovitica General Hospital

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Introduction: *In utero transport refers to the medical transfer and relocation of a pregnant woman or parturient with a fetus in utero from a lower-level maternity unit to a higher-level facility. The purpose is to continue clinical monitoring and diagnostics of the pregnancy, ensure delivery under better conditions, and provide neonatal care in a well-equipped and staffed neonatal intensive care unit.*

Objective: *A retrospective analysis was conducted on in utero transports from the maternity ward of the General Hospital Virovitica during the period from 2016 to 2024. to assess and confirm the advantages of in utero transport.*

Method: *The study examined the number of births, the number of in utero transports, and the institutions to which pregnant women were transferred. It also analyzed the criteria for transport, maternal age and parity, gestational age, and ultrasound-estimated fetal weight. Additionally, the time elapsed from admission to transport, and the use of tocolytics, corticosteroids, and antibiotics were investigated.*

Results: *During the study period, there were 5,319 births and 74 in utero transports (1.4% of total births). The majority of transports were to the University Hospital Center (UHC) Osijek, followed by UHC Zagreb- Petrova, University Hospital Sveti Duh, and UHC Sestre milosrdnice. Most transports occurred at 29-32 weeks and 33-34 weeks of gestation. In more than half of the cases, the transfer was performed within 24 hours, with the administration of tocolytics and fetal lung maturation prophylaxis. The most common indications for transport were threatened or initiated preterm labor and an estimated fetal weight of less than 2000 grams.*

Conclusions: *The study confirms the justification for implementing in utero transport and the regional organization of perinatal care as a whole. Medically appropriate procedures, accurate assessments, and collaboration between institutions, both lower and higher-level maternity units, ensure positive outcomes in perinatal care and the in utero transport program.*

Keywords: PATIENT TRANSFER; CROATIA; PERINATAL CARE

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INTRODUCTION

In utero transfer refers to the medical transport and transfer of a pregnant woman or a woman in labour, with the fetus in utero, from a lower-level maternity hospital to a higher-level facility. The purpose is to ensure continued clinical monitoring and diagnostics, enable delivery under improved conditions, and provide neonatal care in a well-equipped and adequately staffed unit.

Prenatal transport is generally conducted by the referring hospital; the lower-level maternity hospital is responsible for organizing and executing the transfer following prior consultation and agreement with physicians at the receiving higher-level facility. Exceptionally, in urgent cases, consultation may occur during already initiated transport. Transport is mainly carried out by ambulance, but depending on circumstances, it may also involve helicopter or maritime transport, accompanied by a medical team from the referring institution and the necessary medical documentation.

Return *in utero* transfer, from a higher-level to a lower-level maternity hospital, is performed once the risk to the pregnant woman and fetus has subsided and further care can be safely continued at the referring institution.

The decision to initiate *in utero* transport is based on gestational age, estimated fetal weight, specific fetal morbidity, and the assessment of potential vital threat to maternal and fetal health (1, 2).

The criteria for *in utero* transfer to a higher-level maternity hospital include:

- Probability of delivery by the 34th week of gestation, with clinical indicators such as threatened or initiated premature labour, idiopathic spontaneous preterm birth, premature rupture of membranes, bleeding, or signs of imminent danger to the pregnant woman or fetus, indicating premature termination of pregnancy;
- Probability of delivery between the 34th and 37th weeks of gestation, with clinical indicators and potential complications for the mother and fetus;
- Estimated fetal weight <2000 g, or 2000–2500 g with anticipated complications;
- Multiple pregnancies, diagnosed severe fetal anomalies, chromosomal abnormalities, or other fetal or neonatal conditions that may threaten life or complicate recovery without timely obstetric, intensive care, or surgical intervention after birth;
- Maternal diseases or gestational complications (e.g., preeclampsia, HELLP (Hemolysis, Elevated Liver Enzymes and Low Platelet count) syndrome, intrauterine growth restriction, complications of gestational diabetes, severe intraamniotic infection, cholestasis, Rhesus (Rh) or other immunizations, autoimmune diseases, chronic cardiac or pulmonary conditions) that could endanger maternal or fetal health without adequate diagnosis or treatment.

Required medical documentation includes a referral letter stating the reasons for transfer, laboratory and ultrasound findings, cardiotocography records, consultation notes, details of prescribed medications (type and dosage), previous medical records, the pregnancy booklet, and the names of the doctors coordinating the transport (1, 3).

SUBJECTS AND METHODS

A retrospective study on *in utero* transfer was conducted at the Department of Gynecology and Obstetrics of Virovitica General Hospital over a nine-year period (2016–2024). The data was obtained from the medical records of transported pregnant women.

The study examined the number of births, the number of in utero transfers, the institutions to which pregnant women were transferred, maternal age and parity, gestational age at the time of transfer (categorized into groups: 22–28 weeks, 29–32 weeks, 33–34 weeks, 35–36 weeks, and ≥37 weeks), and ultrasound estimates of fetal birth weight.

The time elapsed from hospital admission to transport, as well as the administration of tocolytics, corticosteroids, and antibiotics, were also examined.

The criteria for *in utero* transfer included: threatened or initiated premature labour (e.g., premature rupture of membranes, bleeding, or signs of imminent danger to the mother or fetus indicating premature termination of pregnancy), estimated birth weight <2000 g, multiple pregnancy,

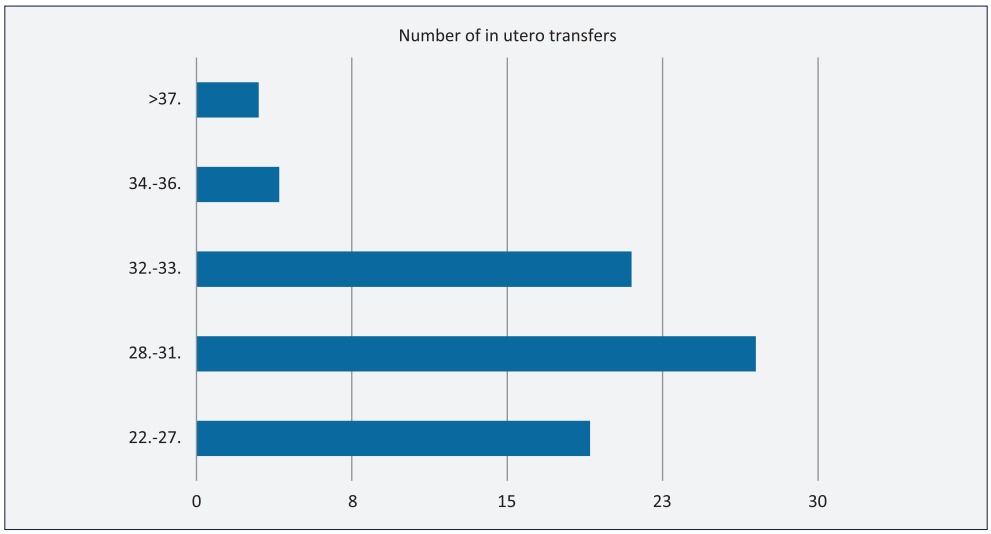

Figure 1. Number of *in utero* transfers from the maternity ward of the General Hospital Virovitica during the period from 2016 to 2024 by gestational age in weeks

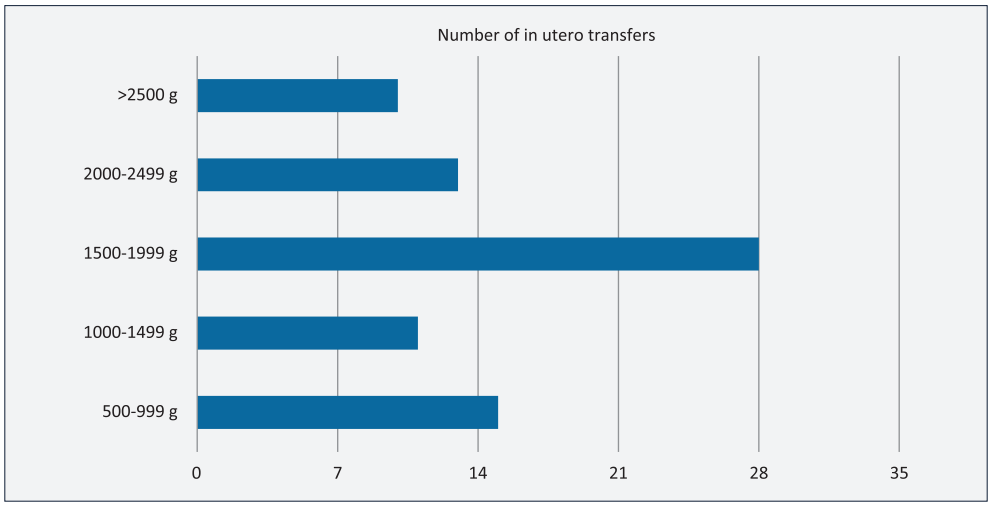

Figure 2. Number of *in utero* transfers from the maternity ward of the General Hospital Virovitica during the period from 2016 to 2024 by ultrasound assessment of fetal weight in grams

severe fetal anomalies, and maternal conditions such as preeclampsia, HELLP syndrome, complications of gestational diabetes, severe intraamniotic infection, Rh immunization, and autoimmune diseases.

The use of patient data for the purposes of this study was approved by the Ethics Committee of Virovitica General Hospital.

The aim of the retrospective study was to analyze *in utero* transfer data from the Department of Gynecology and Obstetrics over the nine-year period and to highlight the benefits and justification of such transport in improving perinatal outcomes.

RESULTS

During the nine-year study period (2016-2024), a total of 5,319 births were recorded at the maternity ward of Virovitica General Hospital, averaging 591 births per year. A total of 74 *in utero* transfers were performed, averaging 8 per year, representing 1.4% of all deliveries.

The highest number of transfers occurred in 2019 and 2022. The majority of transfers were to University Hospital Center (UHC) Osijek (48), followed by UHC Zagreb - Petrova (14), University Hospital Sveti Duh (8), and UHC Sestre milosrdnice (2). During the same period, there were two

return *in utero* transfers back to the General Hospital Virovitica.

The average maternal age was 30.0 ± 5.8 years, with most cases involving a second pregnancy.

The average gestational age of pregnant women at the time of transport was 30.7 ± 4.1 weeks. Figure 1 shows the number of transported pregnant women according to gestational age: 19 at 22-28 weeks, 27 at 29-32 weeks, 21 at 33-34 weeks, 4 at 35-36 weeks, and 3 at ≥37 weeks gestation.

The ultrasound-estimated average birth weight was 1690 ± 732.9 grams. Figure 2 presents the number of *in utero* transfers according to ultrasound-estimated fetal weight in grams.

The average time from admission to transport was 2.5 ± 3.2 days. Transport was carried out within 24 hours in 40 cases, within 2-3 days in 18 cases, and after more than 3 days in 14 cases.

Tocolytics were administered to 42 patients: 8 received intravenous fenoterol, while 34 were treated with nifedipine or indomethacin. Corticosteroids (dexamethasone) were administered in 43 cases, and antibiotics were used in 30 cases (12 times cefotaxime, 2 times azithromycin, and 16 times ampicillin).

The criteria for *in utero* transfer was often of combined nature: 48 patients had threatened or initiated premature labour (including premature rupture of membranes, bleeding, or signs of imminent danger to pregnant woman or fetus, indicating premature termination of pregnancy); 50 had an estimated birth weight <2000 g; 16 twin pregnancies (6 of which resulted from assisted reproduction); 3 had severe fetal anomalies (omphalocele, multicystic kidneys, aortic stenosis); 21 pregnant women had maternal conditions such as preeclampsia, HELLP syndrome, complications of gestational diabetes, severe intraamniotic infection, Rh immunization, and autoimmune diseases; 21 had maternal conditions (e.g., preeclampsia, HELLP syndrome, gestational diabetes complications, severe intraamniotic infection, Rh immunization, autoimmune diseases).

DISCUSSION

According to the guidelines of the North West Neonatal Operational Delivery Network (NWNODN), standard care during *in utero* transfer involves a series of clinical procedures. These include adequate clinical assessment at the lower-level maternity hospital (such as fetal fibronectin testing, ultrasound measurement of cervical length, and use of the Quantitative Innovation in Predicting Preterm birth (QuiPP) tool for predicting preterm birth in symptomatic or high-risk asymptomatic women) as well as the administration of corticosteroids, magnesium sulfate, antibiotic prophylaxis, and tocolytics. Stabilization of maternal conditions such as preeclampsia and antepartum hemorrhage, along with confirmation of satisfactory fetal status, is essential to minimize transport-related risks. Informed consent from the pregnant woman is also required, in accordance with National Institute for Health and Clinical Excellence (NICE) guidelines (4).

The *In Utero Transfer* guideline published by the British Association of Perinatal Medicine (BAPM) is based on clinical evidence confirming that the place of birth is crucial for neonatal survival and reducing morbidity. It also confirms that prebirth transfers significantly reduce neonatal risk compared to postnatal transfers, especially in cases of very early preterm birth, fetal growth restriction, preeclampsia, and other high-risk conditions (5).

The Regulation on the Regional Organization of Hospital Perinatal Care in the Republic of Croatia defines the scope of professional responsibilities, work, and the level of each maternity hospital. These guidelines, developed by perinatal care experts, are based on international best practices and the territorial structure of Croatia (6).

The organizational level and scope of professional activity of each maternity hospital, along with the staffing, training, and equipment of its neonatal care unit, are critical factors that determine the hospital's classification and significantly influence perinatal outcomes, particularly in cases of very low gestational age and low birth weight.

Findings from the University Hospital Center Split support the justification for *in utero* transfer and the regional organization of perinatal care in Croatia. The authors recommend clearer protocols for reporting completed *in utero* transfer, enhanced collaboration between maternity hos-

pitals, and a well-defined hierarchy of responsibilities, including readiness for transfer and intervention at any time (7).

Data from the Department of Obstetrics and Gynecology at the University Hospital Center Zagreb indicate that the most vulnerable group of transported pregnant women is that with a gestational age below 28 weeks, as well as newborns with extremely low or very low birth weight, and those delivered within three days of admission. Perinatal mortality is influenced by gestational age, the interval between admission and delivery, and the response to therapy, including intravenous tocolysis, corticosteroids, antibiotics, and bed rest, which can prolong pregnancy, enhance fetal maturity, and improve the likelihood of successful neonatal care (8).

Newborns delivered before 28 weeks of gestation in lower-level maternity hospitals and transported postnatally have poorer outcomes compared to those transported *in utero* and delivered in tertiary centers. This highlights the importance of ensuring delivery, whenever possible, in higher-level facilities with tertiary neonatal care (9).

Data on the number of *in utero* transfers by hospital in Croatia over the past 10 years is not available. According to previous annual reports on perinatal mortality, our institution belongs to the group with a lower number of transfers per year compared to other institutions (10).

The increasing incidence of preterm births and evolving perspectives on the threshold of neonatal viability underscore the growing need for *in utero* transfer as an essential component of maternal and neonatal care. Multidisciplinary involvement of obstetric, midwifery, and neonatal teams is crucial for effective planning and improved outcomes in preterm deliveries (11).

Chinese authors have also reported advantages of *in utero* over neonatal transport in pregnancies ≤34 weeks of gestation, particularly in cases with alpha-fetoprotein (AFP) ≥1.98 ng/mL and beta-human chorionic gonadotropin (β-hCG) ≥2.05 IU/L. In women with uterine contractions, cervical dilation, or unstable vital signs prior to transport, transfer should be based on a comprehensive risk-benefit assessment to optimize perinatal outcomes. Despite the benefits, adverse outcomes-including perinatal death, neonatal pneumonia, intracranial hemorrhage, sepsis, and asphyxia-remain relatively high in neonates born after *in utero* transfer, often due to inadequate risk assessment. If the risks outweigh the benefits, *in utero* transfer should not be performed (12).

In utero transfer is not recommended in cases of fetal complications at gestational ages below 23 weeks, or in the presence of fetal anomalies or high mortality risk despite active intervention. It is also contraindicated in cases of active labor with cervical dilation greater than three centimeters, unstable maternal conditions requiring intervention during transport (e.g., hemorrhage or uncontrolled hypertension), or maternal or fetal pathology necessitating immediate delivery (13).

This study may contribute to improving perinatal care in the Republic of Croatia and the *in utero* transfer program as an integral part of it, and as such aligns with the goals and commitments outlined in international frameworks (14). The results would be even more valuable if pregnancy outcomes after *in utero* transfer were also investigated, which would require additional engagement and research permissions from the institutions to which the pregnant women were transferred.

CONCLUSION

The results of this retrospective study confirm the justification for implementing *in utero* transfers and the regional organization of perinatal care as a whole. Medically appropriate procedures, accurate assessments, and collaboration between institutions, both lower and higher-level maternity wards, ensure positive outcomes in perinatal care and the *in utero* transfer program.

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SAŽETAK

Transport *in utero* - rodilište Opće bolnice Virovitica

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Transportom in utero smatra se sanitetski transport i premještaj trudnice ili rodilje s plodom u maternici iz rodilišta nižeg u ono više razine, u svrhu nastavaka kliničkog nadzora trudnoće i dijagnostike, osiguranja porođaja u kvalitetnijim uvjetima i liječenja novorođenčeta u ekipiranoj i opremljenoj jedinici neonatalne skrbi.

***Cilj:** Retrospektivno su analizirani podatci o transportima in utero iz rodilišta Opće bolnice Virovitica u razdoblju 2016.-2024. godine kako bi se procijenile i potvrdile prednosti intrauterinalnog transporta.*

***Metoda:** Istražen je broj porođaja, broj učinjenih transporta i ustanove u koje su trudnice transportirane, kriteriji za transport, starosna dob i paritet trudnica, gestacijska dob te ultrazvučna procjena fetalne težine. Istraženo je vrijeme proteklo od prijema do transporta, primjena tokolitika, kortikosteroida i antibiotika.*

***Rezultati:** U istraženom razdoblju bilo je 5319 porođaja i učinjeno je 74 transporta in utero (1,4 % ukupnog broja porođaja). Najveći broj transporta obavljen je u KBC Osijek, potom KBC Zagreb - Petrova, KBC Sveti Duh i KBC Sestre milosrdnice. Prema gestacijskoj dobi najviše ih je transportirano u 29.-32. tjednu i 33.-34. tjednu trudnoće. Kod više od polovine trudnica premještaj je učinjen unutar 24 sata uz primjenu tokolize i profilakse fetalne plućne zrelosti. Kriteriji za transport su najčešće bili prijeteći ili započeti prijevremeni porođaj i procijenjena porođajne težina <2000 g.*

***Zaključci:** Istraživanje potvrđuje opravdanost provedbe transporta in utero i regionalne organizacije perinatalne zaštite u cjelini. Medicinski adekvatno provedeni postupci i dobre procjene, suradnja unutar ustanova, rodilišta niže i ona više razine, osiguravaju dobre rezultate perinatalne zaštite i programa transporta in utero.*

Ključne riječi: TRANSPORT PACIJENTA; HRVATSKA; PERINATALNA SKRB