Polish Medical Air Rescue Interventions Concerning Pregnant Women in Poland: A 10-year Retrospective Analysis

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Background: Even in the normal course of pregnancy, alarming symptoms and obstetric complications can occur, necessitating appropriate care. Medical rescue and Helicopter Emergency Medical Services (HEMS) teams are responsible for responding to emergencies and performing medical emergency procedures on scene and during patient transport to hospital. The purpose of our study was to present the characteristics of HEMS and Emergency Medical Service (EMS) interventions concerning pregnant women in Poland.

Material/Methods: The study involved a retrospective analysis of missions by HEMS and EMS crews of the Polish Medical Air Rescue concerning pregnant women in Poland. The analysis included all HEMS and EMS flights to cases of accidents and other emergencies and air transport missions where medical assistance had been provided to pregnant women between January 2011 and December 2020.

Results: Polish Medical Air Rescue teams were most commonly dispatched to urban areas (79.46%) and for inter-hospital transport (75.85%). The mean patient age was 29.72 years, and the most common diagnosis, in accordance with the International Statistical Classification of Diseases and Related Health Problems (ICD-10), was premature labor (24.38%).

Conclusions: Pregnant patients aged 30 and older and those receiving HEMS and EMS assistance in urban areas were found to have a higher odds ratio for premature labor. A correlation was identified between the diagnosis associated with the Polish Medical Air Rescue intervention and the pregnant woman’s age and location of call.

Keywords: Emergency Medical Services • Pregnancy Complications • Pregnant Women

Full-text PDF: https://www.medscimonit.com/abstract/index/idArt/933029

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Financial support: None declared
Conflict of interest: None declared
**Background**

Pregnancy is a natural and extraordinary condition in the life of a woman. However, even in the normal course of pregnancy, alarming symptoms and obstetric complications can occur, which are typically unanticipated and necessitate appropriate care [1-3]. In addition, pregnant patients hospitalized for obstetric complications can require transfer to a hospital with more advanced care capabilities. Such transfers allow the pregnant patient to go through delivery in a hospital that has the required equipment and facilities to provide the care she and her baby need [4,5].

The Polish Emergency Medical Services system has been established to provide care to patients with severe or life-threatening emergencies. The system is based on cooperation between hospital emergency departments and medical rescue teams, including Helicopter Emergency Medical Service (HEMS) teams. Medical rescue and HEMS teams are responsible for responding to emergencies and performing medical emergency procedures directly on the scene and during patient transport to hospital [6]. HEMS crews consist of a professional pilot, a physician, and an emergency medical technician or nurse. In Poland, HEMS teams are dispatched by the Polish Medical Air Rescue, which also operates an airplane-based Emergency Medical Service (EMS) transport team composed of 2 professional pilots, a physician, and an emergency medical technician or nurse. A total of 22 Polish Medical Air Rescue bases exist in Poland, including 4 bases that operate 24 h, 1 seasonal base operating in the summer, and 1 EMS team. EMS and HEMS missions are carried out by 2 types of aircraft: the Piaggio P.180 Avanti airplane and EC 135 helicopters [7].

In this context, the deployment of Polish Medical Air Rescue crews is particularly important when the incident location is unreachable to ground units owing to challenging topography or when the time of arrival on scene or the duration of patient transport to hospital is a key factor for patient risk [7]. Barker et al (2013) emphasized that air transport is often the only effective means of medical transport for obstetric patients [8].

The purpose of our study was to present the characteristics of HEMS and EMS interventions concerning pregnant women in Poland.

**Material and Methods**

The study involved a retrospective analysis of missions by HEMS and EMS crews of the Polish Medical Air Rescue concerning pregnant women in Poland. The analysis included HEMS and EMS flights to cases of accidents and other emergencies and air patient transport missions in Poland, in which medical assistance had been provided to pregnant women between January 2011 and December 2020. Cases where the transport order had been canceled or the mission had not been performed due to weather conditions or technical problems were excluded from the analysis. Ultimately, based on the established criteria, 443 cases of missions concerning pregnant patients that were completed by Polish Medical Air Rescue crews were included in the analysis. The study and use of data were approved by the director of the Polish Medical Air Rescue. The study protocol was submitted to the Bioethics Committee of the Medical University of Warsaw in Poland, which confirmed that this study did not require consent owing to its retrospective nature (AKBE/18/2021).

The study used medical and operational records of HEMS and EMS crews of the Polish Medical Air Rescue. The documentation analysis was obtained to obtain the following information: date of mission, age of the pregnant patient, main diagnosis based on the International Statistical Classification of Diseases and Related Health Problems (ICD-10), patient clinical parameters, emergency medical procedures performed, and other characteristics of the intervention.

The data obtained from documentation analysis were analyzed statistically using STATISTICA software version 13.2 (Tibco Software Inc., Palo Alto, CA, USA). Qualitative data were described using numbers (n) and percentages (%), while quantitative data were reported using means and standard deviations (SD). Distribution normality for quantitative variables was tested using the Kolmogorov-Smirnov test and the Lilliefors test. Statistically significant differences between qualitative variables were tested using the chi-squared test, and differences between 2 independent groups were tested using the non-parametric Mann-Whitney U test. To determine the odds of specific emergency causes occurring in the studied patient group, we used odds ratios (OR) and 95% confidence intervals (95% CI). Correlations and differences at P<0.05 were considered statistically significant.

**Results**

Polish Medical Air Rescue crews were most commonly dispatched to urban areas (79.46%), for inter-hospital transport (75.85%), using helicopters (92.78%), between 7:00 AM and 6:59 PM (94.58%). Moreover, HEMS and EMS intervened most often in the summer (30.93%). Detailed data are presented in Table 1.

Polish Air Medical Rescue crew flights to cases of accidents and other emergencies in pregnant women were associated with a longer time of activities on scene, compared with inter-hospital transports (15.92 vs 13.91 min). In turn, for other
time and distance variables, the values were higher in interhospital transports than in accident or emergency missions. The identified associations were statistically significant, and detailed data are reported in Table 2.

In the HEMS and EMS missions studied, the mean patient age was 29.72 (SD 5.71) years, and the most common diagnosis, in accordance with ICD-10, was premature labor (24.38%). When assisting pregnant patients, Polish Medical Air Rescue crews most commonly performed intravenous cannulation (51.69%) and oxygen therapy (10.61%). Details on the characteristics of the pregnant patients studied, most commonly performed emergency medical procedures, and test results are shown in Table 3.

Our analyses showed that women under 29 years old were more likely to require intervention for labor at full term (OR 2.02; 95% CI 1.05-3.89), eclampsia or preeclampsia (OR 1.13; 95% CI 0.54-2.37), suspected fetal abnormality or injury (OR 1.55; 95% CI 0.71-3.40), or physical trauma (OR 7.79; 95% CI 1.76-34.47) (Table 4).

Our statistical analysis of associations between the location of HEMS or EMS call and diagnosis demonstrated a statistically significant correlation ($P<0.05$). The calculated odds ratios showed that women receiving the intervention in urban areas were more likely to be diagnosed with premature labor (OR 1.52; 95% CI 0.85-2.71), eclampsia or preeclampsia (OR 2.44;
Table 3. Characteristics of the pregnant patients, most commonly performed emergency medical procedures, and test results.

| Age n (%) |        |        |
|-----------|--------|--------|
| Under 29 y/o | 224 (50.56) |        |
| 30 and older | 219 (49.44) |        |

**Patient age M (SD)**

|                        |        |
|------------------------|--------|
| Premature labor        | 29.72 (5.71) |
| Obstetric complications|        |
| Placental disorders    | 46 (10.38) |
| Parity                 | 44 (9.93)  |
| Bleeding               | 39 (8.80) |
| Eclampsia and preeclampsia | 30 (6.77) |
| Suspected fetal abnormality or injury | 28 (6.32) |
| Premature rupture of membranes | 28 (6.32) |
| Miscarriage            | 20 (4.51) |
| Physical trauma        | 17 (3.84) |
| Other                  | 83 (18.74) |

**ICD-10 diagnosis n (%)**

|  |      |      |
|----------------------------|-------|
| Premature labor            | 52 (23.21) |
| Placental disorders        | 17 (7.59) |
| Parity                     | 29 (12.95) |
| Bleeding                   | 18 (8.04) |
| Eclampsia and preeclampsia| 16 (7.14) |
| Suspected fetal abnormality or injury | 17 (7.59) |
| Premature rupture of membranes | 12 (5.36) |
| Miscarriage                | 9 (4.02) |
| Physical trauma            | 15 (6.70) |
| Other                      | 39 (17.41) |

**Medical emergency procedures n (%)**

|                             |        |
|-----------------------------|--------|
| Sedation                    | 22 (4.97) |
| Mechanical ventilation      | 6 (1.35) |
| Intubation                  | 5 (1.13) |

**Test results**

|                  |        |        |
|------------------|--------|--------|
| ECG n (%)        |        |
| Sinus rhythm     | 420 (94.81) |
| Supraventricular tachycardia | 23 (5.19) |
| Skin color n (%) |        |
| Normal           | 402 (90.74) |
| Pale             | 41 (9.26) |

**Skin moisture n (%)**

|                    |        |        |
|--------------------|--------|--------|
| Dry                | 413 (93.23) |
| Moist              | 30 (6.77) |

**GCS M (SD)**

|        |        |
|--------|--------|
| 14.89  | 0.98   |

**RTS M (SD)**

|        |        |
|--------|--------|
| 11.95  | 0.44   |

**NACA M (SD)**

|        |        |
|--------|--------|
| 3.49   | 1.00   |

**Blood glucose (mg/dL) M (SD)**

|        |        |
|--------|--------|
| 114.21 | 22.83  |

**Respiratory rate M (SD)**

|        |        |
|--------|--------|
| 14.61  | 3.48   |

**Estimated blood loss (mL) M (SD)**

|        |        |
|--------|--------|
| 453.57 | 581.89 |

Table 4. Incidence of emergencies in the group studied by patient age.

| ICD-10 diagnosis | Age | OR | 95% CI | p-Value |
|------------------|-----|----|--------|---------|
| Premature labor  |     |    | 0.88   | 0.57-1.36 |
| Placental disorders | 17 | 0.54 | 0.29-1.01 |
| Parity           |     | 2.02 | 1.05-3.89 |
| Bleeding         |     | 2.02 | 1.05-3.89 |
| Eclampsia and preeclampsia | 16 | 1.13 | 0.54-2.37 |
| Suspected fetal abnormality or injury | 17 | 1.55 | 0.71-3.40 |
| Premature rupture of membranes | 12 | 0.72 | 0.33-1.56 |
| Miscarriage      |     | 0.79 | 0.32-1.95 |
| Physical trauma  |     | 1.76 | 1.64-3.47 |
| Other            |     | 0.84 | 0.52-1.35 |

* Reference variable.
Table 5. Incidence of emergencies in the group studied by location of call.

| ICD-10 diagnosis                                      | Location of call | OR  | 95% CI            | p-Value |
|-------------------------------------------------------|------------------|-----|-------------------|---------|
|                                                       | Urban area*      |     |                   |         |
| Premature labor                                       | 91 (25.85)       | 1.52| 0.85-2.71         |         |
| Placental disorders                                   | 35 (9.94)        | 0.80| 0.39-1.65         |         |
| Parity                                                | 34 (9.66)        | 0.87| 0.41-1.83         |         |
| Bleeding                                              | 25 (7.10)        | 0.42| 0.21-0.85         |         |
| Eclampsia and preeclampsia                           | 27 (7.67)        | 2.44| 0.72-8.22         |         |
| Suspected fetal abnormality or injury                 | 23 (6.53)        | 1.20| 0.44-3.26         |         |
| Premature rupture of membranes                        | 24 (6.82)        | 1.59| 0.54-4.71         |         |
| Miscarriage                                           | 14 (3.98)        | 0.59| 0.22-1.57         |         |
| Physical trauma                                       | 4 (1.14)         | 0.07| 0.02-0.22         |         |
| Other                                                 | 75 (21.31)       | 2.81| 1.30-6.06         |         |
|                                                       | Rural area       |     |                   |         |
|                                                       |                  |     |                   |         |

95% CI 0.72-8.22, suspected fetal abnormality or injury (OR 1.20; 95% CI 0.44-3.26), premature rupture of membranes (OR 1.59; 95% CI 0.54-4.71), or other obstetric complications (OR 2.81; 95% CI 1.30-6.06). Detailed data are shown in Table 5.

Discussion

Specific aspects of pre-hospital care are of interest to researchers around the world [9-13], and this includes the use of HEMS [14-17]. HEMS crew missions are most commonly carried out in response to accidents or emergencies, including cardiovascular problems or injuries [16-18]. In addition, according to DeGennaro et al (2016), the second most common use of HEMS is inter-hospital transport [17]. Our findings indicated that HEMS and EMS crews were, in fact, dispatched mostly for inter-hospital helicopter transport. Research on HEMS transport of patients with physical trauma in the United States performed by Cheung et al (2014) demonstrated that HEMS crews were most often dispatched to rural areas [18]. Similar findings were reported by Rzońca et al (2019) in an analysis of HEMS interventions in Poland [19]. Strehlow et al (2016) also found that women in the third trimester of pregnancy using EMS in India mostly live in rural areas [20]. In turn, our findings indicated that Polish Medical Air Rescue teams typically intervened in cases of pregnant patients in urban areas, during the day, and in the summer.

The details of HEMS interventions have been analyzed in the literature, including the duration of missions and distance covered, broken down by different reasons for intervention [19,21,22]. Baker et al (2013) found that air transport of pregnant patients is required when higher-level hospital is inaccessible by land or when the patient is transported from an island or an area located more than 3 h from the hospital by roads, and there is no alternative method of transport available [8]. Our study also considered the aspects of time and distance. We found that the time of activities on the scene was longer when Polish Medical Air Rescue crews responded to accidents or other emergencies concerning pregnant patients, while all other mission times (response time, time to arrival on scene, patient transport to hospital, and return) and distances (distance to scene, transport distance, and return distance) were longer in cases of inter-hospital patient transport.

Notably, the range of interventions undertaken by HEMS crews is very broad, and a small percentage concern pregnant women with a variety of health problems [15-17,23], which was also confirmed by our present findings. The transport of pregnant women with obstetric complications, such as premature labor or premature rupture of membranes, is particularly important in this context because it enables them to go through delivery in a hospital equipped for intensive neonatal care for premature babies [3,5,8,24]. Sumikawa et al (2020) reported that threatened premature labor was the leading reason for pregnant patient transport [25], which was also found by Barker et al (2013) [8]. Our analyses also identified premature labor as the main reason for HEMS interventions concerning pregnant patients. Importantly, premature labor and premature birth and their consequences represent major challenges not just to the family but also to public health and government systems globally [26-29]. In addition, there is a multitude of factors that contribute to premature births, including socio-demographic, medical, obstetric, and environmental...
determinants [26-28,30-32]. Advanced or very young age of the pregnant patient is also a significant risk factor for preterm birth [26,29]. Women aged under 20 years or above 35 years are more likely to deliver prematurely, as reported by Jiang et al (2018) [29]. Furthermore, we found that patients aged 30 and older and those receiving assistance in urban areas had a higher odds ratio for premature labor.

Michilin et al (2016) analyzed the obstetric care provided by medical emergency teams, specifically including patients’ vital signs [33]. The vital parameters reported by Michilin et al and those in the present analysis were similar, with the exception of blood glucose levels, which were higher, and respiratory rate, which was lower in the Polish patients in the present study. As to the most common emergency medical procedures performed by Polish Medical Air Rescue HEMS and EMS teams in the analyzed interventions for pregnant women, these included intravenous cannulation and oxygen therapy. For comparison, EMS teams in India most often measured basic vital signs and placed the third-trimester pregnant patients in the left lateral position, as reported by Strehlow et al (2016) [20].

Our present study reports the first 10-year retrospective analysis of Polish HEMS and EMS team interventions concerning pregnant patients in Poland, thus providing reliable data. However, the present study also has certain limitations. The analysis only included information contained in the HEMS and EMS crews’ medical and operational documentation, with no data on subsequent patient management, health, or obstetric outcome. These limitations do not, however, impair the quality of the study. Further studies on the health problems of pregnant patients, in particular regarding the multifaceted issue of premature birth, are warranted, so that better and more in-depth understanding of the issue being analyzed can be obtained. This, in turn, will help provide the best possible care to pregnant patients, including care by HEMS and EMS teams of the Polish Medical Air Rescue, which constitutes one of the key parts of the pre-hospital care system.

Conclusions

Polish Medical Air Rescue crews were mostly dispatched to pregnant patients in urban areas, for inter-hospital transport, using helicopters, between 7:00 AM and 6:59 PM, and in the summer.

The time of Polish Medical Air Rescue crew activities on scene was longer in cases of accidents and other emergencies, while the remaining mission times and distances were longer in inter-hospital transport missions. In the HEMS and EMS missions studied here, the mean patient age was 30 years, and the most common diagnosis, in accordance with ICD-10, was premature labor. A correlation was identified between the diagnosis associated with the Polish Medical Air Rescue intervention and the pregnant woman’s age and location of call.

In summary, our study demonstrates the role and importance of Polish Medical Air Rescue crews in the system of care for pregnant women in the event of complications. This results from their ability to quickly reach the incident location and the hospital and from the experience of crew members in terms of severe and life-threatening emergencies.

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