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Strategies to reduce cesarean deliveries: surveying polish obstetricians on External cephalic version practices

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ABSTRACT

Objectives: The cross-sectional survey was conducted aiming to evaluate the knowledge and experiences of the Polish obstetricians and gynecologists regarding the external cephalic version (ECV) and investigate their practices concerning this procedure.

Material and methods: An online survey constituting author-created questionnaire with 22 questions, was distributed among gynecologists and obstetricians. The questionnaire evaluated participants' knowledge about ECV, work experiences, and workplace practices.

Results: Out of 461 respondents, 56.20% were specialists in gynecology and obstetrics. Elective cesarean section (CS) was preferred by 78.70% for primiparas and 73.50% for multiparas with non-cephalic presentation, while ECV would be chosen by 21.3% and 23.6%, respectively. While 73.80% knew centers performing ECV, only 16.70% had actively participated in the procedure. Major differences in the experiences and knowledge regarding ECV were observed based on work experience, and workplace reference level. Experienced physicians showed higher concerns about ECV complications and emergency CS risks. The most common concerns regarding the procedure referred to periprocedural pain, perceived low efficacy, and complications, and were more prevalent among respondents with longer experience and from lower-reference centers.

Conclusions: The study demonstrated that among Polish obstetricians for term pregnancies with non-cephalic presentation, elective cesarean section is preferred over ECV, especially among experienced practitioners. Knowledge about ECV was relatively low, indicating a need for improved educational efforts. Addressing concerns about ECV's safety and efficacy, particularly through enhanced training and anesthesia options, could promote its adoption and reduce CS rates.

Keywords: external cephalic version; breech presentation; delivery

INTRODUCTION

The increasing rate of cesarean deliveries is one of the main problems of modern obstetrics. Concerning the World Health Organization's Statement on Cesarean Section Rates, the ideal rate of cesarean deliveries should not exceed 15%, as a higher percentage of cesarean sections does not reduce maternal and perinatal mortality [1]. According to a report by the National Health Fund, nearly 50% of pregnant women in Poland give birth by cesarean section nowadays, which represents one of the highest percentages in Europe [2]. Non-cephalic presentation of the fetus, which occurs in 3-4% of term pregnancies [3], is one of the main indications of elective cesarean sections performed in our country, regarding obstetric reasons.

External cephalic version (ECV) is a procedure that involves the manipulation of the fetus through the maternal abdomen to a cephalic presentation [5]. According to the literature, ECV increases the likelihood of delivery in the cephalic position at the term of labor and affects the cesarean section rate by reducing it by almost 40% in women primarily diagnosed with breech presentation [3].

The procedure performed by the experienced team is safe, with a risk of serious complications such as fetal death or placental abruption of 0.24% and an emergency cesarean section rate of 0.35% [5–6].

It is recommended by scientific societies, including the American College of Obstetricians and Gynecologists (ACOG) and the Royal College of Obstetricians and Gynecologists (RCOG) [5, 7]. The Polish Society of Gynecologists and Obstetricians, in its recommendations regarding cesarean section, indicates that this way of delivery is preferred in the case of transverse position of a live fetus and in the case of breech presentation in pregnancies over 25 weeks, excluding situations such as delivery of the second twin, advanced stage of the labor and prenatally diagnosed lethal abnormalities of the fetus. The authors of these recommendations also mention ECV as an alternative, which can be suggested to a pregnant woman in case of a non-cephalic presentation of the fetus after the 37^{th} week of gestation in a single pregnancy [8].

In Poland, data on ECV remains scarce [8], and detailed statistics are not available. In 2023, the total number of births in Poland was 272,500, with an estimated 135,000 cesarean sections performed. Estimating that each year, 3-4% of fetuses at term are in a non-cephalic presentation, in 2023, there were approximately 8,175-10,900 patients in Poland for whom an ECV could have been attempted. A recent Polish publication by Kwiatek et al. [4] suggests that the average success rate of ECV is approximately 66.1%. With this level of effectiveness, the potential benefits for the healthcare system could include the nationwide avoidance of a significant number of cesarean sections annually.

In contrast, more comprehensive data are available from other European countries. For instance, in Germany, according to a study by Kohls et al. [9], ECV is routinely practiced in many hospitals and is positively evaluated in terms of effectiveness. Similarly, in France, as reported by Harendarczyk et al. [10], in Norway, according to a study by Devold Pay et al. [11], and in the

Netherlands, as noted by Vlemmix et al. [12], ECV is widely practiced in obstetric units and is routinely offered to patients with breech presentations at term. In the United Kingdom, as shown by Hakem et al. [13], a 10-year review indicates that ECV is regularly performed, with outcomes closely monitored to improve clinical practices.

These data demonstrate that ECV is widely used across many European countries, suggesting that its implementation could also be beneficial in Poland, where this procedure is very rarely offered to patients with non-cephalic fetal presentations at term.

Objectives

The study aimed to assess the knowledge and attitudes about the ECV and investigate the practices of Polish obstetricians regarding this procedure.

MATERIAL AND METHODS

Design

A cross-sectional survey study was conducted online through verified social media groups aimed at gynecologists and obstetricians, utilizing the CAWI (Computer Assisted Web Interview) method. Data were gathered via an online questionnaire, which enabled the collection of information from participants while preserving their anonymity and ensuring their comfort. Participants could complete the questionnaire at any time and place using their computers or mobile devices [14]. The study was conducted from June 10, 2024, to July 15, 2024, and was prepared following the guidelines for observational studies (STROBE) [15] and the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) [16].

Study group

The study group consisted of 461 physicians who were either in training or specialists in the field of obstetrics and gynecology. Before completing the questionnaire, participants were informed about the study's purpose and that the data would be used solely for scientific purposes. The survey was anonymous. Respondents were notified that by completing the questionnaire, they were giving their consent to participate in the study. Participation in the study was voluntary, and no compensation was provided to the participants.

Tool

The 22-question survey was developed by researchers M. M.-D. and J.S., drawing on a comprehensive review of the existing literature. Pilot studies resulted in 25 completed surveys, supplemented by feedback and insights from residents and specialists in obstetrics and gynecology. In the subsequent phase, a team comprising M. M.-D., A.D.-C., R.S., and J.S. reviewed the respondents' suggestions, reached a consensus, and revised the survey questions. The pilot study also evaluated the usability and technical functionality of the electronic survey.

The survey consisted of 22 questions, focusing on participants' work experiences and workplace, with additional questions related to knowledge about ECV. Each correct answer was awarded 1 point, with a maximum possible score of 12 points.

The survey was launched on an online platform (https://www.ecvstudy.pl). It was open to all visitors to the site, and access was provided through a unique link to the survey page. The survey system ensured the completion of the questionnaire before allowing submission.

Recruitment

Residents and specialists in obstetrics and gynecology were recruited for the study through social media and direct contacts. The survey link, along with a description, was shared in two of the largest closed social media groups for gynecologists in Poland, which together include approximately 3,500 members.

Study size

The sample size was calculated based on the total number of obstetricians and gynecologists with a valid medical license who are actively practicing. The data on the number of physicians was obtained from the Central Register of Physicians of the Republic of Poland, maintained by the Polish Supreme Medical Council (*Naczelna Rada Lekarska*). The population of physicians meeting the criteria above amounts to 8,406 [17]. The sample size was calculated assuming a 95% confidence interval, a 5% margin of error, and a fraction of 0.5. The calculations were performed using a calculator available at https://www.naukowiec.org/dobor.html. As a result of this analysis, the minimum required sample size was determined to be 367 respondents.

Statistical analysis

The statistical software package STATISTICA version 13.3 was used to analyze the collected data (TIBCO Software Inc., Palo Alto, California, USA). Quantitative variables with a normal distribution are presented as mean with standard deviation. Data with a distribution significantly different from the normal distribution were presented as a median with a quartile range. Normality was assessed using histograms and quantile-quantile plots. The Wilcoxon test and Kruskal-Wallis test were used for intergroup comparisons of quantitative variables with a distribution significantly different from the normal distribution. A multivariate quantile regression model was used to analyze the relationship between knowledge scores gained by respondents and selected variables. The analysis was performed using the R language in the Rstudio environment. P values less than 0.05 were considered significant. As the study was conducted solely among healthcare professionals and did not involve any personal sensitive patients' data, the IRB approval was not needed.

RESULTS

Overall study results

During the study period, 461 respondents took part in the survey, of whom 56.20% were specialists in gynecology and obstetrics (Tab. 1). Most respondents came from the Silesian and Mazovian voivodeships (Supplementary Tab. 1). The work experience of the participating physicians was respectively 54.90%, and 10.4% between 5 and 20 years, and more than 20 years. A total of 70.5% of the respondents worked in the ward of level II of reference or higher.

Elective cesarean section (CS) as the method of choice in primiparas with term pregnancy and a non-cephalic presentation of the fetus was preferred by 78.70% of the respondents, and in multiparas by 73.50%. The ECV would be chosen by 21.3% and 23.6% of respondents in the case of primiparas and multiparas respectively. Centers performing ECV were known to 73.80% of respondents, 24.90% had worked in them and 16.70% had the personal opportunity to actively participate in the procedure. If needed, the respondents declared that the information about ECV was provided to their patients by 57.70%, while 31% had referred them for the procedure.

According to the experiences of the surveyed participants, the most frequent estimation of the efficacy of the procedure would be 40-60%, which was chosen by 49.2% of respondents concerning primiparous and 44.5% concerning multiparous women (Tab. 2).

Among the respondents, 92.40% correctly identified the 37^{th} week of pregnancy as the optimal time for performing the procedure. The estimated complication rate of ECV of 1-5% was chosen by 53.30% of the respondents and the risk of emergency cesarean section was estimated by most surveyed at 1–10%. The percentage of successful vaginal deliveries after the procedure was estimated at 30-70% by 59.90% of respondents.

As absolute contraindications to the procedure, placenta previa, history of classic cesarean section and placental abruption were chosen, by respectively 98.70%, 91.10%, 96.10% of the

respondents. The median (Q1–Q3) number of points obtained by the respondents was 4 (2–6) and the majority of respondents felt that training in ECV should be provided.

Doctors undergoing specialization in obstetrics and gynecology obtained significantly more points (5, 3–6) than specialists in this field (3, 2–5; $p < 0.001$). Similarly, the respondents having worked for more than 20 years scored the lowest at 2 (1–4) points (Tab. 3). Major differences in the knowledge regarding ECV were also observed depending on the level of reference of the respondents' workplaces. The respondents working in centers of the highest reference level had the highest point sum (5, 3–7) compared to the other groups ($p < 0.001$). There were no significant differences in the number of points obtained by the physicians working only in the outpatient setting, in comparison to hospital employees.

Detailed between-group comparisons

Significant differences were observed between the groups regarding the responses to the survey (Tab. 4). As years of experience increased, physicians were significantly more likely to opt for elective cesarean section in a multiparous term pregnancy with a non-cephalic fetal presentation ($p = 0.007$), as presented in Table 4. Physicians with longer experience were significantly less likely to refer a patient diagnosed with a non-cephalic fetal position to a center for ECV ($p = 0.011$). Physicians with longer length of service significantly less frequently considered the ECV as a highly effective method in primiparas ($p = 0.026$) and multiparas ($p = 0.005$). With increasing years of experience, doctors more often declared a higher rate of complications of ECV ($p < 0.001$) as well as the risk of emergency cesarean section ($p < 0.001$).

Doctors with the longest experience were more likely to consider some relative contraindications for ECV as absolute, with significant differences observed regarding a history of lower uterine cesarean section ($p = 0.012$), oligohydramnios ($p < 0.001$), intrauterine fetal growth restriction ($p < 0.001$), uterine malformations ($p < 0.001$), and estimated fetal weight > 3500 g ($p = 0.002$). Significant differences were also observed, when comparing specialists, with residents (Supplementary Tab. 2).

Other major differences were observed regarding the level of reference of the participants' facilities. Physicians working in centers with lower levels of reference were significantly more likely to opt for elective CS as the procedure of choice in a term pregnancy with a non-cephalic fetal presentation, both in primiparas ($p < 0.001$) and multiparas ($p < 0.001$). Their estimates on the total complication rate as well as, on the emergency cesarean section were significantly higher than among physicians working in the higher reference centers ($p = 0.002$). Doctors working in centers with lower reference levels were also significantly more likely to identify relative contraindications to ECV as being absolute, with the most prominent differences observed concerning the history of lower uterine segment CS ($p < 0.001$), oligohydramnios ($p = 0.02$), and intrauterine fetal growth restriction ($p < 0.001$).

In the quantile regression analysis, for the 50th percentile of respondents, the total obtained points were influenced by variables such as specialization, the reference level of the workplace, and active performing of the ECV at the respondents' workplace ($p < 0.05$) (Tab. 5). Doctors during specialization, working in a ward with a level of reference III or in a place where external fetal versions are performed had higher knowledge. For the 90th percentile of respondents, the total number of correct answers was influenced by the active performing of the ECV at the respondents' workplace ($p < 0.05$), with respondents working in places where ECVs are performed having a higher knowledge of the subject, as presented in Figure 1. For the 10th percentile of respondents, there were no significant variables influencing the number of obtained points (Supplementary Tab. 3).

Concerns of the physicians regarding ECV

On the scale of 1–5 points, the most highlighted (median, Q1–Q3) concern expressed by the respondents was possible pain during the procedure (3, 2–4), high risk of possible complications (3, 2–4), and potential high risk of emergency cesarean section (3, 2–4). The least valued causes raised by the respondents were low procedural efficacy (2, 2–3), and large distances between patient’s dwelling and the facility providing ECV (2, 2–3).

Among subgroups, more experienced clinicians were more inclined to raise concerns related to the possible ECV complication rate ($p < 0.001$). Similarly, the most experienced obstetricians had significantly more pronounced concerns due to the risk of emergency cesarean section after ECV ($p < 0.001$). A low procedural efficacy was also raised by the most experienced physicians ($p < 0.001$) (Tab. 6).

When analyzing the groups according to the level of reference of respondents’ workplace, the single cause of concerns regarding ECV raised significantly more frequently by the physicians working in a hospital with lower reference level were concerns regarding the ECV procedure efficacy ($p = 0.0245$). There were no major differences in physicians' concerns about ECV according to work in the outpatient clinic.

DISCUSSION

Our study provides a comprehensive analysis of the current practices and attitudes toward ECV among obstetricians and gynecologists in Poland. The findings reveal significant preferences, knowledge gaps, and concerns among practitioners that align with, but also exhibit distinct differences from those reported in international literature. A notable finding from our study is the overwhelming preference for elective cesarean section (CS) among Polish obstetricians when managing term pregnancies with non-cephalic presentations. Specifically, 78.7% of respondents preferred CS for primiparas, and 73.5% for multiparas. This preference for CS is consistent with global trends, where concerns about the risks associated with ECV, including potential complications and periprocedural pain, lead many practitioners to favor surgical delivery. These concerns, as noted in studies by Say et

al. [18] and Harendarczyk et al. [10], reflect a cautious approach to breech deliveries that prioritizes perceived safety over the potential benefits of vaginal delivery following a successful ECV. Given the World Health Organization's recommendation that cesarean section rates should ideally not exceed 15%, it is notable that, according to the latest data from the Polish Central Statistical Office [2], nearly half of all births in Poland in 2022 were by cesarean section—one of the highest rates in Europe, which underscores a significant deviation from global guidelines [1]. This high rate suggests a substantial opportunity to increase the use of ECV to reduce reliance on cesarean sections.

Our data reveal that while 73.8% of respondents were aware of centers performing ECV, only 16.7% had actively participated in the procedure. This significant gap between awareness and hands-on experience indicates a potential barrier to the broader adoption of ECV in Poland. Despite recognizing ECV's value, its practical application remains limited, likely due to a lack of training and institutional support. These findings are consistent with those from similar studies in other countries, such as those by Kohls et al. [9] in Germany and Pay et al. [11] in Norway, where ECV is more routinely practiced but still varies widely based on practitioner experience and institutional resources. The importance of experience in ECV success is further highlighted by recent findings from a longitudinal study by Javier Sánchez Romero et al. [19], which demonstrated that increased practitioner experience significantly correlates with higher ECV success rates. This variability underscores the need for continuous professional development, particularly for seasoned practitioners, to ensure that their practices reflect the latest evidence-based recommendations.

The study also highlights significant variability in ECV knowledge and practices based on the level of the reference level of the workplace. Physicians working in higher-reference centers or those actively performing ECV scored higher on knowledge assessments, with a median score of 4 out of 12 points. In contrast, those with more than 20 years of experience scored the lowest, with a median of just 2 points. This suggests that exposure to ECV practices correlates with increased confidence and competence, as noted in studies by Naert et al. [20] and Hutton et al. [21]. A similar situation is observed in the Netherlands, as described by Vlemmix et al. [12], where ECV implementation rates varied significantly among hospitals, ranging from 8.2% to 83.6% of eligible women undergoing the procedure. Higher implementation rates were associated with teaching hospitals, hospitals with special office hours for ECV, larger obstetric units, and those located in larger cities.

Our respondents' primary concerns regarding ECV included periprocedural pain, low efficacy, and the risk of complications, particularly the potential for emergency cesarean section. These concerns were more pronounced among more experienced clinicians and those from lower-reference centers, indicating a cautious approach that may stem from outdated knowledge or limited exposure to current ECV practices. This finding aligns with the literature, where experienced practitioners often exhibit more skepticism toward ECV, as seen in the studies by Rosman et al. [22] and Onah and Nkwo [23]. Despite the concerns expressed by our respondents about the safety of ECV, meta-analytic data suggest that serious complications, such as fetal death or placental abruption, are rare, occurring

in only 0.24% of cases [5]. This discrepancy between perceived and actual risk may contribute to the low adoption of ECV in Poland and underscores the need for updated education on the procedure's safety profile.

As physicians' years of experience increased, they were significantly more likely to opt for elective CS and less likely to refer patients for ECV ($p = 0.007$). Moreover, experienced physicians were more inclined to consider certain relative contraindications as absolute, such as a history of lower uterine cesarean section, oligohydramnios, and intrauterine fetal growth restriction. This conservative stance may be influenced by earlier training and a heightened awareness of potential complications, similar to findings reported by Kok et al. [24]. The regression analysis further highlighted that the total knowledge score was significantly influenced by variables such as specialization, the reference level of the workplace, and whether ECV was actively performed at the respondents' workplace.

The study found that 53.3% of respondents estimated the complication rate of ECV at 1–5% and the risk of emergency cesarean section at 1–10%. These concerns were especially prevalent among more experienced clinicians, who also perceived the efficacy of ECV to be lower. The conservative approach of these practitioners is likely influenced by their experiences, which may include cases where ECV was less successful or associated with complications. This cautious outlook is reflected in the relatively low rates of ECV participation and the higher reliance on elective CS, as seen in our study and in the literature [22, 23]. Both ACOG and RCOG recommend ECV as a safe and effective option for reducing the incidence of breech births and cesarean sections [7, 9]. Betrán et al. [25] have identified several interventions effective in reducing unnecessary cesarean sections, such as improved patient counseling and standardized guidelines, which could be adapted to promote ECV in Poland. Implementing these strategies could help align Polish cesarean rates more closely with WHO recommendations.

The observed differences in ECV knowledge and practice suggest a pressing need for updated training programs and clear clinical guidelines. The fact that physicians in higher-reference centers performed better in knowledge assessments underscores the importance of institutional support and ongoing education in promoting the safe and effective use of ECV. As noted in the studies by Coltart et al. [26], Hutton et al. [20] and Baumgart [27], enhancing hands-on training and establishing standardized protocols could improve ECV uptake and outcomes, ultimately reducing the reliance on cesarean sections. Velzel et al. [28] emphasize the importance of using reliable prediction models to guide clinical decisions for ECV, further supporting the need for targeted educational interventions to address gaps in ECV knowledge and practice among Polish obstetricians.

Strengths and Limitations

A notable strength of this study is that it represents the first large-scale questionnaire-based investigation into the topic of ECV within the Polish context. The significance of ECV cannot be

overstated, particularly as the rate of vaginal deliveries has been consistently declining worldwide, raising concerns about the medical and economic implications for women of reproductive age [1, 8]. Globally, the proportion of cesarean sections increased from 12% in 2000 to 21% in 2015. In Poland, these statistics are even more alarming, with cesarean section rates approaching 50%, significantly surpassing both the European average and WHO standards [2].

Firstly, the results are based on a survey created by the investigators, which has not been validated and was conducted primarily online, largely through social media channels. As a result, the representativeness of the obstetricians' population may be incomplete, particularly among the older group of doctors, who are less likely to engage in such surveys. Additionally, selection bias cannot be ruled out, as those who chose to participate in the study may have had a greater interest or more experience with t.

Furthermore, the geographical and institutional distribution of respondents might introduce another layer of bias. The majority of respondents were concentrated in two regions of Poland, with over 70% working in level II or higher reference centers. Given that physicians from higher-level facilities demonstrated greater knowledge on the subject, the overall findings of the study may not fully reflect the practices and knowledge of obstetricians and gynecologists working in other regions or lower-level reference centers.

CONCLUSIONS

In our analysis, most Polish obstetricians prefer elective cesarean section over ECV for term pregnancies with non-cephalic presentations. This trend underscores a significant need to increase awareness and education about ECV, as overall knowledge of the procedure is relatively low among practitioners. To address this gap, comprehensive ECV training should be integrated into the obstetrics and gynecology curriculum. Furthermore, the Polish Society of Gynecologists and Obstetricians may consider developing and disseminating detailed guidelines on ECV covering the procedure, contraindications, and management of potential complications. By addressing concerns about the safety and efficacy of ECV, these efforts could promote the utilization of ECV and contribute to a reduction in elective cesarean section rates in cases of non-cephalic fetal presentations.

Article information and declarations

Data availability statement

The data are available upon the request.

Ethics statement

Not applicable

Author contributions

Maisa Manasar-Dyrbus 70%; Agnieszka Drosdzol-Cop 5%; Szymon Stojko 5%; Rafal Stojko 5%; Jakub Staniczek 15%.

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Conflicts of Interest

The authors report there are no interests to declare.

Supplementary material

Supplementary Tables 1–3, Questionnaire.

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Table 1. Baseline characteristics of the studied cohort and general experiences with ECV (total n = 461)

Descriptive statistics		
Profession of the respondents		
Specialist in obstetrics and gynecology	259	56.20%
Doctor undergoing the specialization in obstetric and gynecology	202	43.80%
Work experience of the respondents		
5–20 years	253	54.90%
< 5 years	160	34.70%
> 20 years	48	10.40%
Current workplace (the sum could exceed 100%)		
Clinical hospital	108	23.40%
Provincial hospital	172	37.30%
Outpatient clinic	256	55.50%
County hospital	176	38.20%
Reference level of the department of respondents' workplace		
Ist level of reference	122	26.50%
IInd level of reference	235	51.00%
IIIrd level of reference	90	19.50%
Not applicable	14	3.00%
Management of choice of the respondents in a primiparous, term pregnancy with a non-cephalic fetal presentation		
Elective cesarean section	363	78.70%
ECV	98	21.30%

Management of choice of the respondents in a multiparous, term pregnancy with a non-cephalic fetal presentation		
Elective cesarean section	339	73.50%
ECV	109	23.60%
Vaginal delivery in case of breech presentation	13	2.80%
Experience with ECVs (the sum could exceed 100%)		
Knowledge concerning a facility performing the procedure	340	73.80%
Working in a facility performing the procedure	115	24.90%
History of observing the procedure	82	17.80%
History of performing/assisting for the procedure	77	16.70%
Experience of referral/providing information concerning the patient diagnosed with non-cephalic fetal position for the procedure		
Providing information	266	57.70%
Providing information and referring	143	31.00%

ECV — external cephalic version

Table 2. Answers to the questions concerning the knowledge about ECV (n = 461). Each correct answer was granted with one point

The estimated effectiveness of ECVs performed in primiparous women according to the respondents		
< 20%	36	7.80%
20–40%	164	35.60%
40–60%	227	49.20%
60–80%	34	7.40%
The estimated effectiveness of ECV performed in multiparous women according to the respondents		
< 20%	4	0.90%
20–40%	91	19.70%
40–60%	205	44.50%
60–80%	161	34.90%
Optimal time for performing the ECV of the fetus:		
at the earliest on the due date	19	4.10%
at 35 weeks' gestation	16	3.40%
at 37 weeks' gestation	426	92.40%
The estimated total percentage of ECV complications is:		
1–5%	241	52.30%
5–15%	199	43.20%
More than 15%	21	4.60%
The risk of emergency cesarean section in ECV procedure is:		
< 1%	184	39.90%
1–10%	250	54.20%
10–15%	27	5.90%
The estimated percentage of cases where the fetus returns to its previous position after a successful ECV:		
1–5%	280	60.70%
5–15%	167	36.20%

More than 15%	14	3.00%
The estimated percentage of vaginal births after successful ECV:		
> 70%	146	31.70%
10–30%	39	8.50%
30–70%	276	59.90%
Absolute contraindications for ECV:		
Placenta previa	455	98.70%
History of lower uterine segment cesarean section	215	46.60%
Oligohydramnios	205	44.50%
History of classical cesarean section	420	91.10%
Intrauterine fetal growth restriction	236	51.20%
Placental abruption	443	96.10%
Uterine defects	257	55.70%
Lack of fetal well-being before the procedure	418	90.70%
Estimated fetal weight > 3500 g	89	19.30%

ECV — external cephalic version

Table 3. Comparison of the responses to the questions concerning knowledge on ECV, according to the respondents' work experience. and center's level of reference

The respondents' specialization	**N**	**Median (Q1-Q3)**	**p**
Obstetrics and gynecology specialist	259	3 (2–5)	< 0.001
Obstetrics and gynecology resident	202	5 (3–6)	
The respondents' work experience	**N**	**Median (Q1-Q3)**	**p**
< 5 years	160	5 (3–6)	< 0.001
5–20 years	253	3 (2–6)	
> 20 years	48	2 (1–4)	
Reference level of the department of respondents' workplace	**N**	**Median (Q1-Q3)**	**p**
I level	122	3 (2–5)	< 0.001
II level	235	3 (2–6)	
III level	90	5 (3.257)	

Table 4. Comparison of the responses to the questions concerning knowledge on ECV and management of choice in pregnancies with non-cephalic presentation according to the respondents' work experience

Work experience	**5–20 years**	**Less than 5 years**	**More than 20 years**	**P**
n	**253**	**160**	**48**	
Management of choice of the respondents in a multiparous. Term pregnancy with a non-cephalic fetal presentation				

Elective cesarean section	174 (68.8)	128 (80.0)	37 (77.1)	0.007
ECV	72 (28.5)	30 (18.8)	7 (14.6)	
Vaginal delivery in case of breech presentation	7 (2.8)	2 (1.2)	4 (8.3)	
Experience of referral concerning the patient diagnosed with non-cephalic fetal position for the procedure				
No	160 (63.2)	120 (75.0)	38 (79.2)	0.011
Yes	93 (36.8)	40 (25.0)	10 (20.8)	
The estimated effectiveness of ECVs performed in primiparous women according to the respondents				
< 20%	20 (7.9)	8 (5.0)	8 (16.7)	0.026
20–40%	93 (36.8)	49 (30.6)	22 (45.8)	
40–60%	123 (48.6)	88 (55.0)	16 (33.3)	
60–80%	17 (6.7)	15 (9.4)	2 (4.2)	
The estimated effectiveness of ECVs performed in multiparous women according to the respondents				
< 20%	2 (0.8)	1 (0.6)	1 (2.1)	0.005
20–40%	51 (20.2)	21 (13.1)	19 (39.6)	
40–60%	114 (45.1)	74 (46.2)	17 (35.4)	
60–80%	86 (34.0)	64 (40.0)	11 (22.9)	
The estimated total percentage of ECV complications is:				
1–5%	119 (47.0)	109 (68.1)	13 (27.1)	< 0.001
5–15%	122 (48.2)	48 (30.0)	29 (60.4)	
More than 15%	12 (4.7)	3 (1.9)	6 (12.5)	
The risk of emergency cesarean section in ECV procedure is:				
< 1%	109 (43.1)	65 (40.6)	10 (20.8)	< 0.001
1–10%	133 (52.6)	88 (55.0)	29 (60.4)	
10–15%	11 (4.3)	7 (4.4)	9 (18.8)	
Absolute contraindications for ECV:				
History of lower uterine segment cesarean section	114 (45.1)	69 (43.1)	32 (66.7)	0.012
Oligohydramnios	120 (47.4)	53 (33.1)	32 (66.7)	< 0.001
Intrauterine fetal growth restriction	137 (54.2)	65 (40.6)	34 (70.8)	< 0.001
Estimated fetal weight > 3500 g	58 (22.9)	17 (10.6)	14 (29.2)	< 0.001

ECV — external cephalic version

Table 5. Results of the dependency analysis of knowledge scores and selected variables conducted using a quantile regression model

50 percentile (n = 461)

Variable	Beta	CI lower	CI upper	p value
Proffesion of the respondents				
Doctor undergoing the specialization in obstetric and gynecology	2	0.99	3.01	< 0.001
Length of service of the respondents				
Less than 5 years	0	–1.04	1.04	1.00
More than 20 years	0	–0.79	0.79	1.00
Reference level of the department of respondents' workplace				
IInd level of reference	0	0.63	0.63	1.00
IIIrd level of reference	2	0.89	3.11	< 0.001
Experience with ECVs				
Working in a facility performing the procedure	2	1.01	2.99	< 0.001

90 percentile (n = 461)

Variable	Beta	CI lower	CI upper	p value
Proffesion of the respondents				
Doctor undergoing the specialization in obstetric and gynecology	2	–2.22	6.22	0.35
Length of service of the respondents				
Less than 5 years	–0.5	–2.60	1.60	0.64
More than 20 years	–3	–7.50	1.50	0.19
Reference level of the department of respondents' workplace				
IInd level of reference	2.5	–5.42	10.42	0.54
IIIrd level of reference	3	–3.68	9.68	0.38
Experience with ECVs				
Working in a facility performing the procedure	2.5	0.63	4.37	0.01

ECV — external cephalic version

Table 6. Concerns of the medical staff in relation to the ECV procedure, according to the respondent's work experience

Work experience	Concerns of the medical staff	n	median	q1	q3	p value
5–20 years	High risk of complications of ECV	253	3	2	4	
< 5 years		160	2	2	4	
> 20 years		48	4	3	4	< 0.001
5–20 years	High risk of emergency cesarean section after ECV	253	3	2	4	
< 5 years		160	2	2	3	
> 20 years		48	4	3	4	< 0.001
5–20 years	Pain during the procedure	253	3	2	4	
< 5 years		160	3	2	3	
> 20 years		48	3	2	4	0.705
5–20 years	Low procedural efficacy of the ECV	253	3	2	3	
< 5 years		160	2	2	3	
> 20 years		48	3	3	4	< 0.001
5–20 years	Distance of the facility performing the ECV	253	2	2	3	
< 5 years		160	2	1	3	
> 20 years		48	2	2	3	0.986

ECV — external cephalic version

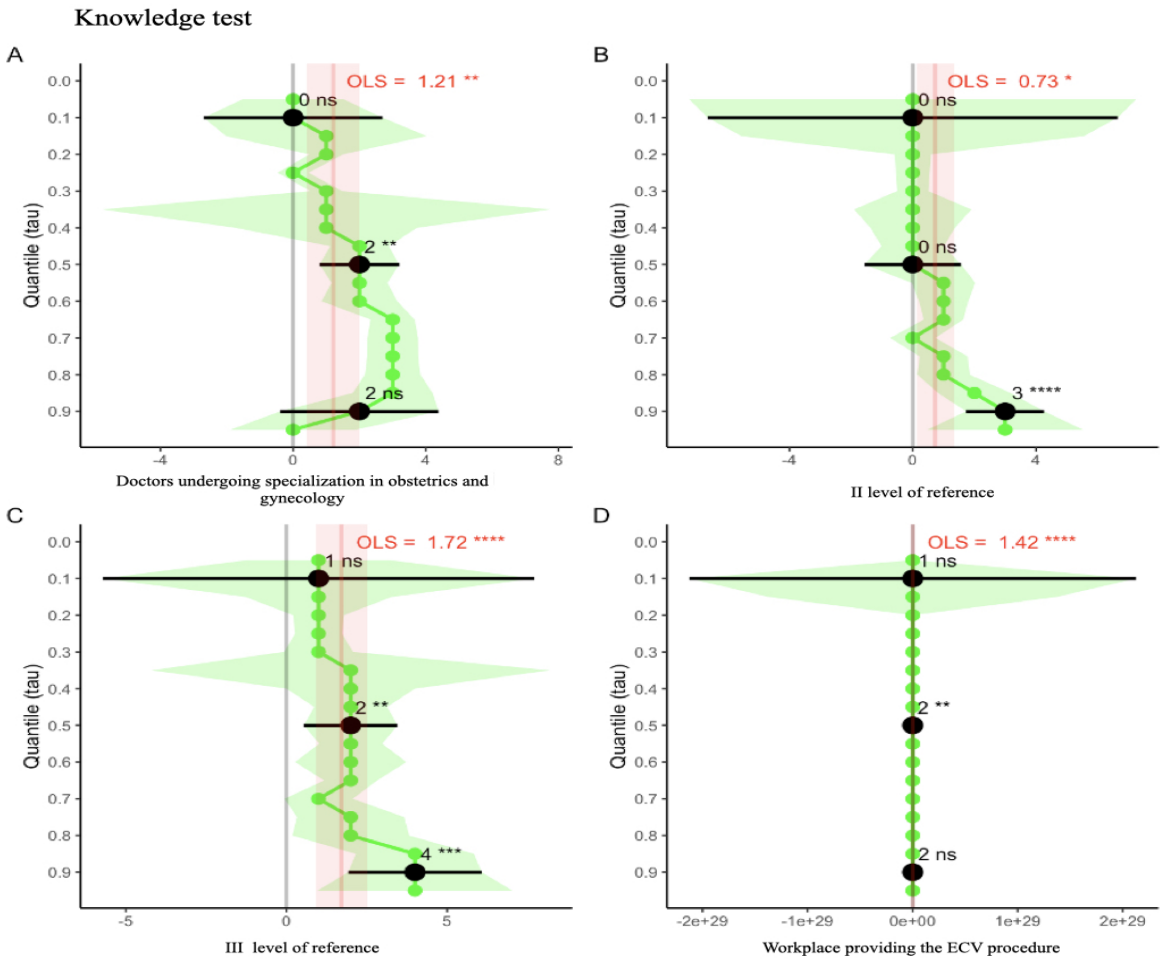

Figure 1. Results of the analysis of the relationship between knowledge scores and selected variables conducted using a quantile regression model — tenth, fiftieth and ninetieth percentile (n = 461)

Supplementary Table 1. Supplementary information regarding the studied cohort (total n = 461)

Descriptive statistics		
In which province do you work?		
Dolnośląskie	32	6.90%
Kujawsko-pomorskie	21	4.60%
Lubelskie	17	3.70%
Lubuskie	20	4.30%
Łódzkie	20	4.30%
Małopolskie	30	6.50%
Mazowieckie	66	14.30%
Opolskie	14	3.00%
Podkarpackie	20	4.30%
Podlaskie	17	3.70%
Pomorskie	24	5.20%
Śląskie	108	23.40%
Świętokrzyskie	16	3.50%
Warmińsko-mazurskie	15	3.30%
Wielkopolskie	24	5.20%
Zachodniopomorskie	17	3.70%
Do you think that training on ECV should be provided?		
No	15	3.30%
No opinion	61	13.20%
Yes	385	83.50%

Supplementary Table 2. Comparison of the responses to the questions concerning knowledge on ECV and management of choice in pregnancies with non-cephalic presentation in specialist and residents groups

Profession	**Obstetric and gynecology specialists**	**Obstetric and gynecology residents**	**p value**
n	**259**	**202**	
Work experience			
5–20 years	207 (79.9)	46 (22.8)	<0.001
< 5 years	6 (2.3)	154 (76.2)	
> 20 years	46 (17.8)	2 (1.0)	
Reference level of the department of respondents' workplace			
I level	53 (21.5)	69 (34.3)	0.007
II level	136 (55.3)	99 (49.3)	
III level	57 (23.2)	33 (16.4)	
Management of choice of the respondents in a primiparous, term pregnancy with a non-cephalic fetal presentation			
Elective cesarean section	193 (74.5)	170 (84.2)	0.017
ECV	66 (25.5)	32 (15.8)	
Management of choice of the respondents in a multiparous, term pregnancy with a non-cephalic fetal presentation			
Elective cesarean section	173 (66.8)	166 (82.2)	0.001
ECV	76 (29.3)	33 (16.3)	
Vaginal delivery in case of breech presentation	10 (3.9)	3 (1.5)	
Experience with ECVs (the sum in the column could exceed 100%)			
Knowledge concerning a facility performing the procedure	180 (69.5)	160 (79.2)	0.025
Working in a facility performing the procedure	75 (29.0)	40 (19.8)	0.032
History of observing the procedure	45 (17.4)	37 (18.3)	0.005
History of performing/assisting for the procedure	56 (21.6)	21 (10.4)	
Experience of referral/providing information concerning the patient diagnosed with non-cephalic fetal position for the procedure			
Providing information	148 (57.1)	118 (58.4)	0.858
Providing information and referring	89 (34.4)	54 (26.7)	0.098
The estimated effectiveness of ECVs performed in primiparous women according to the respondents			
< 20%	26 (10.0)	10 (5.0)	0.002
20–40%	104 (40.2)	60 (29.7)	
40–60%	117 (45.2)	110 (54.5)	
60%-80%	12 (4.6)	22 (10.9)	
The estimated effectiveness of ECV performed in multiparous women			

according to the respondents			
< 20%	3 (1.2)	1 (0.5)	0.005
20–40%	65 (25.1)	26 (12.9)	
40–60%	112 (43.2)	93 (46.0)	
60–80%	79 (30.5)	82 (40.6)	
Optimal time for performing the ECV of the fetus:			
at the earliest on the due date	10 (3.9)	9 (4.5)	0.598
at 35. weeks'gestation	9 (3.4)	7 (3.5)	
at 37. weeks'gestation	240 (92.7)	186 (92.1)	
The estimated total percentage of ECV complications is:			
1–5%	110 (42.5)	131 (64.9)	<0.001
5–15%	133 (51.4)	66 (32.7)	
More than 15%	16 (6.2)	5 (2.5)	
The risk of emergency cesarean section in ECV procedure is:			
< 1%	98 (37.8)	86 (42.6)	0.236
1–10%	142 (54.8)	108 (53.5)	
10–15%	19 (7.3)	8 (4.0)	
The estimated percentage of cases where the fetus returns to its previous position after a successful ECV			
1–5%	143 (55.2)	137 (67.8)	0.020
5–15%	108 (41.7)	59 (29.2)	
More than 15%	8 (3.1)	6 (3.0)	
The estimated percentage of vaginal births after successful ECV:			
> 70%	64 (24.7)	82 (40.6)	0.001
10–30%	28 (10.8)	11 (5.4)	
30–70%	167 (64.5)	109 (54.0)	
Do you think that training on ECV should be provided?			
No	12 (4.6)	3 (1.5)	< 0.001
No opinion	53 (20.5)	8 (4.0)	
Yes	194 (74.9)	191 (94.6)	
Absolute contraindications for ECV:			
Placenta previa	254 (98.1)	201 (99.5)	0.350
History of lower uterine segment cesarean section	133 (51.4)	82 (40.6)	0.028
Oligohydramnios	136 (52.5)	69 (34.2)	< 0.001
History of classical cesarean section	236 (91.1)	184 (91.1)	1.000
Intrauterine fetal growth restriction	147 (56.8)	89 (44.1)	0.009
Placental abruption	253 (97.7)	190 (94.1)	0.080
Uterine defect	170 (65.6)	87 (43.1)	< 0.001
Lack of fetal well-being before the procedure	230 (88.8)	188 (93.1)	0.161
Estimated fetal weight > 3500 g	68 (26.3)	21 (10.4)	< 0.001

ECV — External Cephalic Version

Supplementary Table 3. Results of the dependency analysis of knowledge scores and selected variables conducted using a quantile regression model
10 percentile (n = 461)

Variable	Beta	CI	CI	p

		lower	upper	value
Proffesion of the respondents				
Doctor undergoing the specialization in obstetric and gynecology	1	–4.98	6.98	0.74
Length of service of the respondents				
Less than 5 years	–1	–7.02	5.02	0.74
More than 20 years	0	–17.76	17.76	1.00
The degree of reference of the department of respondents' workplace				
IInd level of reference	0	–3.54	3.54	1.00
IIIrd level of reference	1	–2.06	4.06	0.52
Experience with ECVs				
Working in a facility performing the procedure	1	–19.22	21.22	0.92

ECV — External Cephalic Version

Questionnaire (answers to questions 14-21 considered as a correct one indicated in italics for the purpose of this analysis)

1. What is your profession? (single-choice question)
    a. Doctor undergoing the specialization in obstetrics and gynecology
    b. Specialist in obstetrics and gynecology

2. In which province do you work? (expandable list with the names of the Polish provinces)

3. What is your length of service? (single-choice question)
    a. Less than 5 years
    b. 5–20 years
    c. More than 20 years

4. What is your work place? (multiple-choice question)
    a. Outatient clinic
    b. County hospital
    c. Provincial hospital
    d. Clinical hospital

5. What is the level of reference of the department you work in? (single-choice question)
    a. Ist level of reference
    b. IInd level of recerence
    c. IIIrd level of reference
    d. Not applicable

6. What is your management of choice in a primiparous, term pregnancy with a non-cephalic fetal presentation? (single-choice question)

a. Elective cesarean section

b. External cephalic version

7. What is your management of choice of the respondents in a multiparous, term pregnancy with a non-cephalic fetal presentation? (single-choice question)

    a. Elective cesarean section

    b. External cephalic version

    c. Vaginal delivery in case of breech presentation

8. Do you know facilities performing external cephalic version?

    a. Yes

    b. No

9. Do you work in facility, where external cephalic versions are perfomed?

    a. Yes

    b. No

10. Have you ever actively participated in external cephalic version procedure?

    a. Yes, I have observed the procedure

    b. Yes, I have performed/assisted for the procedure

    c. No

11. Have you ever provided information about external cephalic version to the patient diagnosed with non-cephalic fetal presentation?

    a. Yes

    b. No

12. Have you ever referred the patient to the facility performing external cephalic version?

    a. Yes

    b. No

13. What, in your opinion, might be the concerns of the medical staff in relation to the external cephalic version procedure? (Please answer each sub-point: 1-Strongly no, 2-Rather not, 3-I have no opinion, 4-Rather yes, 5-Decided yes)

    a. High risk of complications of ECV

    b. High risk of emergency cesarean section after ECV

    c. Pain during the procedure

    d. Low procedural efficacy of the procedure

    e. Distance of the centre performing the ECV from the patient's place of residence

14. What is the estimated effectiveness of external cephalic versions performed in primiparous women? (scored question, 1 point maximum)

    a. < 20%

    b. 20%–40%

    c. 40%–60%

    d. 60%–80%

15. What is the estimated effectiveness of external cephalic versions performed in multiparous women? (scored question, 1 point maximum)

    a. < 20%

    b. 20–40%

    c. 40–60%

d. 60–80%

16. What is the optimal time for performing the external cephalic version of the fetus? (scored question, 1 point maximum)

    a. at the earliest on the due date

    b. at 35 weeks' gestation

    c. at 37 weeks' gestation

17. What are the absolute contraindications for external cephalic version (multiple-choice, (scored question, 5 points for not selecting answers b, c, e, g, i):

    a. Placenta previa

    b. History of lower uterine segment cesarean section

    c. Oligohydramnios

    d. History of classical cesarean section

    e. Intrauterine fetal growth restriction

    f. Placental abruption

    g. Uterine defects

    h. Lack of fetal well-being before the procedure

    i. Estimated fetal weight > 3500 g

18. What is the estimated total percentage of external cephalic version complication? (scored question, 1 point maximum)

    a. 1-–5%

    b. 5–15%

    c. More than 15%

19. What is the estimated risk of emergency cesarean section in external cephalic version? (scored question, 1 point maximum)

    a. < 1 %

    b. 1–10 %

    c. 10–15%

20. What is the estimated percentage of cases where the fetus returns to its previous position after a successful external cephalic version? (scored question, 1 point maximum)

    a. 1–5%

    b. 5–15%

    c. More than 15%

21. What is the estimated percentage of vaginal births after successful external cephalic version? (scored question, 1 point maximum)

    a. > 70%

    b. 30–70%

    c. 10–30%

22. Do you think that training on external cephalic version should be provided?

    a. Yes

    b. No

    c. I have no opinion