Do lifestyle factors influence the rate of complications after amniocentesis?

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Abstract

Background. The impact of lifestyle factors including health-promoting physical activity on complication rate following amniocentesis is unclear.

Objectives. To examine the further course of pregnancy in patients undergoing amniocentesis in relation to selected risk factors including the level of health-promoting activity and occupational work on the complication rate after genetic amniocentesis.

Material and methods. Medical records from 317 diagnostic amniocenteses were analyzed and 230 procedures carried out on 219 pregnant women were included in the study.

Results. The mean maternal age was 34.50 ± 5 years (range: 22–47 years). In the patients studied, amniocentesis was performed at 12–24 gestational weeks with a median at 16 gestational weeks (mean: 16.13 ± 2.02 weeks). Overall, 174 amniocenteses (75.6%) did not reveal any genetic disorder while 56 (24.4%) confirmed a genetic disorder. One hundred procedures (43.5%) were followed by at least 1 complication, while 130 procedures (56.5%) were uneventful. The following complications were observed: general pain – 37 (16%), fever – 5 (2.2%), dizziness – 7 (3%), amniotic fluid leakage – 5 (2.2%), vaginal bleeding – 3 (1.3%), and fetal death – 11 (4.8%). The following lifestyle factors were reported: use of stimulants – 12 (5.2%), occupational work – 158 (68.7%), commuting – 137 (59.6%), and physical activity – 62 (27%). Abdominal pain/uterine contractions were significantly more frequent with generalized pain, fever, vaginal bleeding, and physical activity. The presence of dizziness correlated with generalized pain in women who were working and commuting. Working occupationally when pregnant correlated positively with practicing sport. Better newborn condition was significantly correlated with older gestational age and longer sick leave.

Conclusions. Physical activity performed by pregnant women after amniocentesis increases the risk of post-procedural complications such as abdominal pain, uterine contractions, dizziness, and syncope. Reducing physical effort 2 weeks after the procedure is recommended. Further studies are warranted.

Key words: amniocentesis, lifestyle factors, occupational work, prenatal care, adverse events

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Introduction

Congenital defects and genetic abnormalities of the fetus may appear both in high-risk and healthy pregnant women, hence the necessity to conduct prenatal tests in all pregnant women.¹ It has been estimated that approx. 2–3% of children are born with a congenital malformation. Out of these, 65–70% of cases are of unknown etiology, 20% have genetic disorders, 3–5% chromosomal aberrations, 2–3% disorders as a consequence of infection, and 2–3% disorders caused by a teratogenic factor.² Chromosomal aberrations alone occur in approx. 50% of aborted embryos, in 2% of fetuses at 16–18 weeks of pregnancy and in 1 in 160 cases of live births.³

Proper prenatal diagnosis reduces perinatal mortality. The detection of abnormalities in fetal development makes it possible to start targeted monitoring during pregnancy, introduce indirect treatment through the mother, correct defects using intrauterine procedures, prepare the fetus for an earlier delivery, and properly arrange the conditions and medical staff to carry out medical intervention immediately after delivery. Information about serious chromosome aberration allows for earlier termination of a pregnancy that would end in spontaneous abortion or death during or after delivery in most cases.^{4,5}

Invasive prenatal testing poses a risk of complications to healthy fetuses, therefore their use is only advised when screening suggests abnormalities or a family history of fetal abnormalities exists.^{1,6} Prenatal tests are conducted according to evidence-based medicine using reliable and up-to-date methods for assessment of the condition of the fetus.^{7,8} Invasive examinations, including amniocentesis, provide practically 100% accuracy in the detection of chromosomal aberrations. During amniocentesis, amniotic fluid is sampled which may be associated with the occurrence of potential complications.⁹ As early as in 1986, Tabor et al. found that amniocentesis is associated with an increased rate of miscarriage.¹⁰ The prevalence of such consequences dropped from 2.1% to 1.4% after the introduction of ultrasound control during amniotic fluid collection. An analysis of 68,000 amniocenteses showed that the rate of pregnancy loss equals approx. 0.33%. Other possible complications include injuries of the fetus caused by the needle, such as scars visible on the skin of the newborn, eye injuries and subdural hematoma. Additionally, an increased risk of the development of respiratory distress syndrome and pneumonia has been reported.¹⁰ Obstetric complications such as bleeding and amniotic fluid leakage appear so rarely that it is difficult to estimate the risk of their occurrence.¹¹ The percentage of miscarriages after amniocentesis correlates positively with the age of women at the intervention, the number of punctures, the presence of myomas, and obesity of the pregnant woman but are negatively correlated with the operator's experience.^{1,12–14} Lifestyle factors have not been discussed in the literature although patients often ask healthcare providers

whether they should change their daily activity directly after the amniocentesis and later in the course of their pregnancy.

Taking into account the constant development of prenatal testing and the lack of studies on the impact of lifestyle factors on the prevalence of complications after amniocentesis, the aim of the study was to examine the further course of pregnancy in patients undergoing amniocentesis in relation to selected risk factors including the level of health-promoting activity and occupational work on the complication rate after genetic amniocentesis.

Material and methods

Medical records from 317 diagnostic amniocenteses conducted in our institution were used. Every patient was invited to participate in the study and to answer a questionnaire. We failed to contact 16 patients (5%) due to a lack of response or changes in contact information. Another 70 patients (22.2%) refused to participate in the study. Ultimately, the study group included 230 procedures carried out on 219 pregnant women. Clinical data was retrieved retrospectively from patient medical records. Data on daily living activities and lifestyle factors were retrieved from a postnatal survey. The study was conducted after obtaining approval from the Commission of Bioethics at Wrocław Medical University, Poland. All subjects gave a written informed consent for participation in the study.

The demographic and clinical data collected, as well as the answers provided by the patients in the survey, were statistically analyzed using the STATISTICA software package v. 10 (StatSoft, Tulsa, USA). The data was presented as means (standard deviation – SD) and percentages. Comparisons between groups were conducted with χ^2 test or Fisher exact test and Mann–Whitney U test. Spearman's correlation rank was used to determine correlations between variables. Differences were considered statistically significant at $p < 0.05$.

Results

In the study group, 216 amniocenteses (93.9%) were performed on singleton pregnancies (including 6 amniocenteses performed as repeated procedures), while 14 amniocenteses (6.1%) were performed on twin pregnancies. The mean maternal age was 34.50 ± 5 years (range: 22–47 years). In the patients studied, amniocentesis was performed at 12–24 gestational weeks with a median at 16 gestational weeks (mean: 16.13 ± 2.02 weeks). Patients referred for amniocentesis were mainly primigravidae ($n = 92$; 40%), secundigravidae ($n = 79$; 35%) and tertigravidae ($n = 44$; 19%), while quadri- and quintigravidae ($n = 12$; 5% and $n = 3$; 1%) constituted a small percentage of the study group. Overall, 208 (94.43%) of 230 amniocenteses were performed in naturally conceived

pregnancies, while 22 (9.57%) were in pregnancies conceived with assisted reproductive technology (ART).

The studied amniocenteses were divided into 2 groups; group A in which the result did not reveal any genetic disorder ($n = 174$; 75.6%) and group B in which genetic disorder was confirmed ($n = 56$; 24.4%). The most common defect ($n = 22$) was Down syndrome (trisomy 21). It was concomitant with a congenital heart defect in 2 cases, and in 1 case with Klinefelter syndrome, an exceptionally rare comorbidity of Down syndrome. Multiple fetal anomalies were found in 2 cases, Edwards syndrome in 5 and Turner

syndrome in 6. The remaining cases comprised rare genetic disorders.

In the study group, a total of 100 procedures (43.5%) were followed by at least 1 complication, while 130 procedures (56.5%) were uneventful. The most common complications included abdominal pain and contractions as well as generalized pain. Table 1 presents complications after amniocentesis by the result of the procedure.

In the present study, several lifestyles factors and their association with complications following amniocentesis were examined. Factors analyzed included the use of stimulants

during pregnancy, occupational work and the necessity to commute, duration of sick leave, and health-promoting physical activity. Stimulants were used in 12 (5.2%) of the 230 procedures; genetic disorder was diagnosed in 1 baby. Of the stimulant users, 4 women were smoking (3–10 cigarettes a day) and 3 were consuming alcohol – mainly wine. Overall, 72 procedures were performed on women who did not work during pregnancy and 158 on those who did. The mean distance traveled to work for working women was 56.3 km. Only 20 women did not have to commute. Sixteen working women were not on sick leave at all, while 132 were on sick leave with an average number of sick weeks of 13.9 (range: 1–38 weeks). Some women were engaged in various forms of health-promoting physical activity: 62 procedures were performed on physically active women while 68 on physically inactive ones. The following types of physical activity were reported: swimming, walking, mountain hiking, jogging, prenatal exercise classes, gymnastics, and dancing classes. The presence of selected lifestyle factors is summarized in Table 2.

Correlation analysis showed clinically interesting associations. Abdominal pain/uterine contractions were significantly more frequent as concomitant with generalized pain, fever, vaginal bleeding, and physical activity in the course of pregnancy. The presence of dizziness correlated with generalized pain in women who were working and commuting. Fetal death was positively correlated with genetic disorders. Additionally, working occupationally when pregnant correlated positively with practicing sports.

The condition of the newborn as measured with Apgar score was significantly positively correlated with the duration of pregnancy (the longer pregnancy, the better the condition of the newborn)

Table 1. Comparison of complication rate following amniocentesis by result of genetic testing

Complication	Group A ($n = 174$) normal karyotype	Group B ($n = 56$) genetic disorder	p-value
Abdominal pain/uterine contractions *	3.39 (1.48)	2.95 (1.29)	0.8794
Generalized pain **			
no	144 (82.76%)	49 (87.50%)	0.4009
yes	30 (17.24%)	7 (12.5%)	
Fever ***			
no	172 (98.85%)	53 (94.64%)	0.0604
yes	2 (1.15%)	3 (5.36%)	
Dizziness/syncope ***			
no	167 (96.17%)	54 (93.43%)	0.8795
yes	7 (3.83%)	2 (3.57%)	
Amniotic fluid leakage ***			
no	172 (98.85%)	53 (94.64%)	0.0604
yes	2 (1.15%)	3 (5.36%)	
Vaginal bleeding ***			
no	172 (98.85%)	55 (97.78%)	0.7151
yes	2 (1.15%)	1 (2.22%)	
Fetal death ***			
no	170 (97.7%)	49 (87.50%)	0.0017
yes	4 (2.30%)	7 (12.50%)	

Results presented as number (%) or mean (standard deviation – SD). Bold denotes statistical significance. * Mann–Whitney U test; ** χ^2 test; *** Fisher exact test.

Table 2. Comparison of lifestyle factors following amniocentesis by result of genetic testing

Lifestyle factor	Group A ($n = 174$) Normal karyotype	Group B ($n = 56$) Genetic disorder	p-value
Stimulants *			
no	163 (99.39%)	55 (83.33%)	<0.001
yes	1 (0.61%)	11 (16.67%)	
Occupational work **			
no	55 (30.61%)	17 (30.36%)	0.861
yes	119 (68.39%)	39 (69.64%)	
Commuting **			
no	71 (40.81%)	22 (39.29%)	0.84
yes	103 (59.19%)	34 (60.71%)	
Sick leave [weeks] ***	19 (11.75–27.25)	7.0 (3.25–12)	<0.001
Physical activity *			
no	125 (71.84%)	43 (76.79%)	0.943
yes – sporadic	31 (17.82%)	9 (16.07%)	
yes – 2–5 times a week	8 (4.60%)	2 (3.57%)	
yes – every day	10 (5.75%)	2 (3.57%)	
Distance from work [km]	10.0 (6.0–22.0)	12.5 (8.5–23.0)	0.4239

Results presented as numbers (%) or median (interquartile range). Bold denotes statistical significance. * Fisher exact test; ** χ^2 test; *** Mann–Whitney U test.

Table 3. Correlations between study parameters described by Spearman's correlation rank coefficients

Factor	Gestational age at amniocentesis	Apgar at 1 min	Parity	Abdominal pain/uterine contractions	Generalized pain	Fever	Dizziness/syncope	Amniotic fluid leakage	Vaginal bleeding	Fetal death	Genetic disorder	Stimulants	Occupational work	Commuting	Physical activity	Sick leave
Gestational age at amniocentesis	–	0.00	0.08	–0.10	–0.10	–0.15	–0.03	–0.09	–0.09	–0.04	–0.05	0.01	0.15	0.11	0.01	–0.23
Apgar at 1 min	0.00	–	0.09	–0.02	–0.06	–0.15	–0.02	–0.11	–0.02	–0.33	–0.71	0.06	–0.05	0.04	0.08	0.37
Parity	0.08	0.09	–	–0.02	–0.04	–0.05	–0.09	–0.09	0.02	0.02	–0.01	0.04	0.01	0.02	–0.01	0.00
Abdominal pain/uterine contractions	–0.10	–0.02	–0.02	–	0.58	0.14	0.17	0.07	0.18	0.05	–0.04	–0.05	–0.02	0.05	0.15	0.07
Generalized pain	–0.10	–0.06	–0.04	0.58	–	0.02	0.22	0.02	0.16	0.01	–0.06	–0.05	–0.01	–0.02	0.09	0.10
Fever	–0.15	–0.15	–0.05	0.14	0.02	–	–0.03	0.39	–0.02	0.11	0.12	–0.03	0.10	0.11	0.05	–0.13
Dizziness/syncope	–0.03	–0.02	–0.09	0.17	0.22	–0.03	–	0.12	–0.02	–0.05	–0.01	0.05	0.14	0.18	0.15	–0.06
Amniotic fluid leakage	–0.09	–0.11	–0.09	0.39	0.02	–	–0.02	–	–0.02	–0.03	0.02	–0.03	0.10	0.10	0.05	–0.03
Vaginal bleeding	–0.09	–0.11	–0.09	0.39	0.02	–	–0.02	–	–	–0.03	0.02	–0.03	–0.09	–0.10	–0.07	0.02
Fetal death	–0.04	–0.33	0.02	0.16	–0.02	–0.05	–	–0.03	–	0.21	–	–0.09	0.01	0.10	–0.09	–0.01
Genetic disorder	–0.05	–0.71	0.06	–0.71	0.01	0.11	–0.05	–0.03	–0.03	0.21	–	–	–0.01	–0.08	–0.05	–0.52
Stimulants	0.01	0.06	0.04	–0.05	–0.03	0.12	0.05	–0.03	–0.03	–0.05	–0.09	–	–0.01	0.04	0.07	0.07
Occupational work	0.15	–0.05	0.01	–0.02	–0.01	0.10	0.05	–0.03	–0.03	–0.05	0.01	–0.01	–	0.71	0.22	–0.45
Commuting	0.11	0.04	0.02	0.05	–0.02	0.11	0.10	0.10	0.10	0.10	0.04	0.04	0.71	–	0.22	–0.23
Physical activity	0.01	0.08	–0.01	0.05	0.09	0.05	0.15	0.05	–0.07	–0.09	–0.05	0.07	0.22	0.22	–	–0.13
Sick leave	–0.23	0.37	0.00	0.07	0.10	–0.13	–0.06	–0.03	0.02	–0.01	–0.52	0.07	–0.45	–0.23	–0.13	–

Bold denotes statistical significance.

and being on sick leave (newborns of mothers who were on sick leave had higher Apgar scores). Table 3 shows correlations between the parameters studied.

Discussion

Taking into account lifestyle factors, our study showed that women who received an amniocentesis result indicating genetic disorder used stimulants more often and had a lower number of sick leave weeks in comparison to women in whom amniocentesis yielded normal results. Of the amniocentesis complications, only fetal death occurred significantly more often in the group with genetic disorders than in the groups with normal karyotype. Occupational work during pregnancy and commuting to work significantly correlated with the occurrence of dizziness and physical activity. Health-promoting physical activity was associated with more frequent abdominal pain and contractions as well as dizziness and syncope. Being on sick leave correlated with better newborn status as measured with Apgar score.

The health benefits of physical activity have been well documented. According to the American College of Obstetricians and Gynecologists (ACOG), physical activity during pregnancy has minimal risks for the fetus and the mother. The ACOG also recommends moderate-intensity exercise for at least 20–30 min per day on most or all days of the week, noting however that further research is needed to study the effects of exercise on pregnancy-specific outcomes.¹⁵ Many women attend prenatal exercise classes, but there are no criteria that would help qualify women for such physical activity. Most of them decided to participate on their own, while some discuss the possibility of practicing sports with their physician, who can advise based on his/her experience and individual assessment of health status. Women also report barriers that reduce their physical activity during pregnancy such as health problems (80%) and the feeling of being tired (46%). Another barrier is lack of time (34%), which affects pregnant women who already have children to a greater degree (47%) than primiparae (14%).¹⁶ Pre-pregnancy habits are transferred to the period of pregnancy.

Women who had been physically inactive before becoming pregnant notice more barriers in accessing physical activity and fewer benefits than those who had previously practiced sports.¹⁷

Only a few papers address practicing sports during uncomplicated pregnancy in low-risk pregnant women. Those studies are usually conducted on small groups of patients and have a high rate of withdrawal. A wide variety of forms of physical activity, as well as diversified duration and intensity of physical effort, is another source of heterogeneity. Nevertheless, the meta-analysis conducted by Perales et al. did not identify any study which reported a negative effect of health-promoting physical activity on the health of the mother and the fetus in the low-risk group. The greatest benefits were obtained from the combination of aerobic and endurance exercises compared to only 1 type of exercise. The greatest benefit of the exercises was the improvement of cardiorespiratory fitness, which worsens as pregnancy advances.¹⁸

In the literature, few reports on the impact of physical activity on the risk of eclampsia in pregnant women have been published. Spracklen et al. compared the following groups of patients: 258 pregnant women with preeclampsia, 221 pregnant women with hypertension and 174 healthy pregnant women (control group). The results of this study showed the positive impact of the health-promoting physical activity on blood pressure. A significant drop in the risk of preeclampsia and hypertension was observed for every 10-minute increase per week; however, this risk increased significantly when women performed heavy household chores for longer than 180 min per week.¹⁹ Sauder et al. found that physical activity was the only modifiable risk factor which can reduce the risk of glycemic disorders.²⁰ A meta-analysis of pooled data from 10 studies including 3,401 participants revealed a slight protective effect against the development of gestational diabetes mellitus.²¹ The study by Szegda et al. conducted among Latina women aimed to reveal an association between physical activity and the development of depression. The authors did not observe any significant associations between health-promoting physical activity and the presence of depressive symptoms, although they assumed that physical activity might have a potential protective mechanism against depressive symptoms.²²

The best of our knowledge, no studies on the effect of physical activity on well-being were previously performed among pregnant women undergoing amniocentesis. In our study, only 26% of women referred for amniocentesis practiced sport or participated in exercise classes such as swimming, walking, mountain hiking, jogging, prenatal exercise classes, gymnastics, and dancing classes. Moreover, only 12 of the active women (6%) were practicing every day. Taking into account complications following amniocentesis, a significant correlation was found between physical activity and the occurrence of pain; therefore, a recommendation to patients

undergoing amniocentesis to abandon physical activity for at least the period of increased risk of complications should be considered. On the other hand, a significant positive correlation between the intensity of physical effort and gestational weeks at birth suggests that physical activity may reduce the effect of other risk factors of premature delivery. Interestingly, the significant correlation between physical activity and occupational work indicates that physically active women are more active in general because a higher level of physical activity was not associated with less family burden; the correlation between physical activity and parity was insignificant. This topic is interesting and worth future research.

Occupational work may be associated with heavy physical effort or the need to maintain an unnatural position for a longer period of time. Spracklen et al. confirmed the impact of occupational work on preeclampsia risk. They found that this risk decreased only in women who worked in a standing position. A 1-hour increase in the time spent on feet decreased the risk of preeclampsia; however, an increase in standing in one place at work increased the risk of hypertension. Women who spend more than 40 h per week at work were at greater risk than those who worked less than 36 h per week.¹⁹

In the present study on women subjected to amniocentesis, 115 women (69%) worked during pregnancy and most of them commuted to work. Both occupational work and the need to commute were significantly correlated with dizziness following amniocentesis. Correlations were also examined for women on sick leave and revealed that a greater number of sick leave weeks was significantly correlated with older gestational age and better health condition of the newborn as measured with Apgar score. These relationships may indicate that women on sick leave had more time to rest and use healthcare resources.

Stimulants have a well-documented negative impact on the course of pregnancy. Cigarette smoke is particularly harmful and contributes to the development of such pathologies as a low birth weight of the fetus, intrauterine growth restriction, preterm delivery, oligohydramnios, disorders of placental circulation, abnormal placental location, premature detachment of the placenta, and premature rupture of the amniotic membranes.^{23,24} Despite this, approx. 25% of Polish women smoke, and half of them continue to smoke during pregnancy.²⁵ Smoking may increase the risk of consequences after amniocentesis because it is an invasive procedure which is associated with puncture of maternal abdominal tissues and fetal membranes as well as in some cases even the placenta. The negative impact of smoking on wound healing after surgery has been thoroughly examined. Smoking alters tissue micro-environment. It changes inflammatory and regenerative response on a cellular level, leading to a delay in wound healing and increase in complication rate.^{26–29} The most common addiction reported by women in the study group was smoking. However, the percentage of smokers was

very low compared to the average in the Polish population and amounted to 2%. Four smokers disclosed their habit and reported smoking 3–10 cigarettes a day. There was no association between smoking and any of the complications following amniocentesis. This may be due to the low number of smokers in the study group. On the other hand, a low percentage of smokers confirms high awareness and high compliance with medical recommendations.

In the framework of the current study, apart from answering closed-ended questions about their pregnancy, the amniocentesis procedure and further course of the pregnancy from the procedure to the delivery, patients could add personal comments and suggestions, and describe subjective feelings associated with amniocentesis. After the analysis of those comments, we conclude that most of the women experienced high-intensity anxiety before the procedure due to the uncertainty of the test result, worries about the further course of pregnancy and the lack of knowledge about amniocentesis itself. The women highlighted that good interpersonal contact with the staff performing the procedure, calm and honest conversation before amniocentesis, and discussing the procedure and possible complications in a comprehensible way play a key role in eliminating the described anxiety. In the opinion of patients, such conduct of the amniocentesis significantly alleviated the psychological tension and anxiety that appeared at qualification for amniocentesis and the decision to undergo the procedure. Reports from the literature are in line with our findings. They confirm that pregnant women experience anxiety both before amniocentesis and after receiving a positive result.³⁰

Conclusions

Physical activity performed by pregnant women after amniocentesis increases the risk of post-procedural complications such as abdominal pain and uterine contractions as well as dizziness and syncope. To increase the safety of amniocentesis, it seems reasonable to limit the physical activity of the woman within 2 weeks directly after the procedure. The impact of lifestyle factors on the frequency of complications turned out to be an interesting aspect of the safety analysis of invasive procedures; therefore, it is worth studying this topic in the future, especially in the scope of prenatal testing.

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