

Perioperative complications of gynecologic surgery in diabetic patients

Powikłania okołoperacyjne u pacjentek z cukrzycą poddanych zabiegom ginekologicznym

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Abstract

Objectives: The aim of the study was to estimate whether diabetes was an independent risk factor for perioperative complications in patients undergoing gynecologic surgery.

Material and methods: The study population consisted of 182 women (diabetics and controls) who underwent elective gynecologic surgery. Each patient without diabetes from the control group and matched for age and body mass index diabetic patient were admitted with the same gynecologic diagnosis, underwent the same gynecologic procedure, were operated on in the same operating room and were hospitalized within the same time interval. The following parameters of the perioperative period were compared between every matched pair of patients (diabetic vs. non-diabetic patient): number and characteristics of intra- and postoperative complications, length of postoperative hospitalization, decrease in hemoglobin level, increase in body temperature, and postoperative use of antibiotics.

Results: The study revealed no statistically significant differences between the diabetic patients and pair-matched controls in terms of the examined parameters of the perioperative period.

Conclusions: Diabetes was not an independent risk factor for early postoperative complications after gynecologic procedures in the examined population. Good pre-operative glycemic control and strict cooperation of the diabetologist with the surgeon in the perioperative period resulted in reduction of the complication rate to the level typical for non-diabetic patients.

Key words: **diabetes / perioperative complications / gynecologic surgery /**

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Streszczenie

Cel pracy: Celem pracy było ustalenie, czy w badanej grupie pacjentek które zostały poddane zabiegom ginekologicznym, cukrzyca stanowiła niezależny czynnik ryzyka powikłań okołoperacyjnych.

Materiał i metody: Badaniami objęto 182 kobiety (grupa badana i kontrolna łącznie) które zostały poddane zabiegom oraz operacjom ginekologicznym w trybie planowym. Każdej pacjentce z cukrzycą przyporządkowano pacjentkę bez cukrzycy: w podobnym wieku, o zbliżonej wartości wskaźnika masy ciała, z tym samym ginekologicznym rozpoznaniem zasadniczym, poddaną takiemu samemu zabiegowi operacyjnemu i na tej samej sali zabiegowej/operacyjnej, co pacjentka z grupy badanej oraz hospitalizowaną w tym samym okresie czasu. Następujące parametry okresu okołoperacyjnego zostały porównane między każdą pacjentką z cukrzycą i przyporządkowaną jej pacjentką bez cukrzycy: liczba i charakter powikłań, czas pooperacyjnej hospitalizacji, spadek stężenia hemoglobiny, wzrostu temperatury ciała, pozabiegowe zastosowanie antybiotyków.

Wyniki: Nie wykazano istotnych statystycznie różnic między grupą cukrzycową a grupą kontrolną w zakresie analizowanych parametrów okresu okołoperacyjnego.

Wnioski: Cukrzyca nie stanowiła niezależnego czynnika ryzyka wczesnych powikłań okołoperacyjnych po zabiegach ginekologicznych we wszystkich rodzajach zabiegów. Dobre przedoperacyjne wyrównanie cukrzycy, ocena pacjentek z cukrzycą przez lekarza diabetologa oraz ścisła współpraca okołoperacyjna między lekarzem ginekologiem a diabetologiem umożliwia ograniczenie liczby powikłań okołozabiegowych w grupie chorych z cukrzycą poddawanych zabiegom ginekologicznym do poziomu odpowiadającego pacjentkom bez cukrzycy.

Słowa kluczowe: **cukrzyca, powikłania okołoperacyjne, operacje ginekologiczne /**

Introduction

The dramatically growing incidence of diabetes has become a serious health issue all around the world. At present, approximately 387 million people worldwide are affected by the disease and the number is expected to exceed 590 million by 2025. In Europe, 52 million people have diabetes, with 33.1% unaware of this fact [1]. In Poland, over two million citizens are diabetic, whereas pre-diabetic states such as impaired glucose tolerance or impaired fasting glucose, very likely leading to diabetes in the future, have been recognized in twice as many cases [1, 2]. Due to the steadily increasing number of diabetic patients and alarming predictions for the future, the World Health Organization (WHO) has acknowledged diabetes as the first non-infectious epidemic [2].

According to the American Diabetes Association (ADA), diabetics constitute 12-25% of all hospitalized patients [3,4]. Surgical procedures in that group of patients account for 5-8% of all surgical interventions [5]. Furthermore, 25% of diabetic patients will probably require an operation at least once in their lifetime [6]. Several studies have confirmed worse perioperative outcomes in diabetic as compared to non-diabetic subjects [7, 8, 9]. Therefore, the Polish Diabetes Association has issued detailed recommendations concerning the ways of managing diabetic patients before, during, and after surgery [10].

Objectives

The aim of the study was to determine whether diabetes was an independent risk factor for perioperative complications in patients who underwent gynecologic surgery. The reason why this issue was taken up is that the majority of studies which evaluate the influence of diabetes on the perioperative period concern cardiac surgery. This is probably due to the fact that diabetic patients constitute as many as 16-28% of all cardiac surgery patients [11]. The number of studies which determine the

relation between diabetes and early postoperative outcomes after gynecologic surgery is limited.

Material and methods

The group consisted of 182 women (diabetics and controls), hospitalized at the Third Department of Gynecology, Medical University of Lublin, who underwent elective gynecologic surgery between January 1, 2002 and December 31, 2009. The study group included 91 women with known diabetes, whereas the control group comprised patients without diabetic history. Only diabetic patients who had good glycemic control, according to the recommendations of the Polish Diabetes Association, and with no contraindications to the surgery, according to the diabetologist, were enrolled in the study [10].

In order to determine whether diabetes was an independent risk factor for perioperative complications, controls were pair-matched to the diabetic patients using the following criteria:

- the same gynecologic diagnosis
- the same gynecologic procedure in the same operating room
- similar age (+/- 5 years)
- similar BMI (+/- 5 kg/m²)
- the gynecologic procedure - within the same time interval (+/- 6 months).

Patient medical records from 2002-2009 were analyzed. The period from the day prior to the surgery until the day of discharge was evaluated in every case.

Blood glucose measurements in the perioperative period were performed from capillary blood (glucometer Accu-Chek Active, Roche). In all diabetic patients treated with insulin, fasting, preprandial and postprandial glucose was evaluated. In case of patients who did not receive the meal, blood glucose was evaluated before they received glucose solution which served as an energy supply.

Based on the recommendations of the Polish Diabetes Association, normoglycemia in the perioperative period was established at 100-180 mg/dl, whereas abnormal glycemia was defined as >180 mg/dl and continuous glycemia < 100 mg/dl [10].

The following parameters were analyzed in the evaluation of the perioperative period:

- number and characteristics of intra- and postoperative complications
- postoperative length of hospitalization (days)
- hemoglobin level (g/dl) before and after the operation - decrease in hemoglobin level of at least 1 g/dl was considered as significant
- body temperature (°C) - the rise in body temperature above 37.5°C on the second day after the surgery or in the following days was considered as significant
- postoperative antibiotic therapy (apart from standard perioperative antibiotic prophylaxis which was administered to all the patients).

The above parameters were compared between all diabetic patients and the corresponding controls. The obtained results are presented as the median and value of lower and upper quartile for the variables with non-normal distribution. Differences between the two examined groups were assessed with Mann-Whitney U test. For the purpose of feature distribution analysis in patients with diabetes and matched controls, the convenient type of χ^2 test- Matched Pair Case-Control was applied. The p-value of <0.05 was considered as statistically significant.

Results

Median patient age was 59 (interquartile range: 50-68) and 61 (interquartile range: 52-72) in the control group and the study group, respectively. Statistical analysis did not reveal significant differences in terms of age between the two examined groups ($p>0.05$). Median BMI value was 30.0 kg/m² (interquartile range: 26.9-33.8), and 31.1 kg/m² (interquartile range: 27.0-37.5) in the control group and the study group, respectively. Statistical analysis did not reveal significant differences in terms of BMI values between the two examined groups ($p>0.05$).

According to the methodology of the study, each and every patient from the control group underwent the same gynecologic procedure as the matching diabetic patient. The laparotomic procedures (hysterectomy and adnexectomy) constituted 34.0% of all interventions (31 interventions in each group of patients); dilation and curettage (D&C) – 27.5% (25 interventions), hysteroscopy – 16.5% (15 interventions), sling procedures and surgery for uterine prolapse – 12.1% (11 interventions), and cervical biopsies with D&C – 9.9% (9 interventions).

In the population of the diabetic subjects, 80 patients (87.9%) were found to be normoglycemic, whereas the remaining 11 patients had abnormal glycemia in the perioperative period and long-standing glycemia, exceeding 180 mg/dl. There were no patients with continuous glycemia <100 mg/dl.

Complications in the diabetic group developed in 11 patients (12.1%). There were no patients with more than one complication. The most common complications included urinary tract infection and poor wound healing/surgical site infection (SSI). In the control group, complications occurred in 6 patients (6.6%). Similarly to the diabetic group, there were no patients with more than one complication among controls. There were no

significant differences between the two examined groups in terms of the number of complications ($p=0.24$). The most common complication was impaired wound healing (Table I). Selected data about diabetic patients who developed complications in the perioperative period are presented in Table II.

Statistical analysis revealed no statistically significant differences between diabetic patients and their matched controls in terms of the number of complications, postoperative hemoglobin decrease, rise in body temperature, use of antibiotics, or length of hospitalization (Table III).

Discussion

Our results are consistent with the available literature reports about the most common perioperative complications which develop after surgery. However, in our study, complication rate both, in the diabetic group and controls, was lower than in the majority of the cited studies [12-18]. Infections, including urinary tract infections (UTIs), are among the most common complications developing after surgery [13, 15, 19-21]. This is true for both, diabetics and patients with normal glucose metabolism. UTIs constitute 40-60% of all hospital-acquired infections, including 0.9% of UTIs developing in gynecological wards. It is estimated that UTIs which develop after gynecological procedures can affect 10-30% of the patients [22, 23].

According to the literature concerning gynecological surgery, infectious complications are followed by bleeding problems [21, 24, 25], which was also the case in our study.

Careful selection and matching of the patients allowed to rule out the influence of factors other than diabetes, which could also potentially increase the risk of perioperative complications, thus changing the results obtained in our study. Additionally, the evaluated parameters (number of complications, hemoglobin loss, rise in body temperature, use of antibiotics postoperatively, length of hospitalization) did not differ significantly between diabetics and corresponding non-diabetics.

Thus, based on our results, it seems safe to conclude that diabetes was not an independent risk factor for perioperative complications in the examined population. Although this conclusion seems to be promising, it requires a detailed analysis when considering the well-known negative influence of diabetes on surgery outcomes.

Firstly, it has to be underlined that comparative analysis of the results obtained in this study is problematic. Apart from a single study by Morricone et al., no publications were found which would compare the perioperative period between diabetics and non-diabetics in a similar way. In their study, 350 diabetic patients and 350 non-diabetics were matched for age, BMI, type of intervention, comorbidities, smoking habits, etc. These authors proved diabetes to be an independent risk factor for perioperative complications such as neurological and renal complications, higher re-operating rate, prolonged ICU stay, or more frequent blood transfusions. Interestingly, diabetic patients did not show higher mortality rate than non-diabetics. However, the study concerned cardiac surgery, whose range and character is incomparable with gynecologic surgery. Furthermore, it is not certain whether all the patients underwent elective surgery or if some of them underwent emergency surgery. Finally, there is no information pertaining to metabolic control of diabetes in the patients enrolled in the study [7].

Table I. Percentage distribution of perioperative complications in the diabetic group and controls.

Complication	Number and (%) of patients from the diabetic group	Number and (%) of patients from the control group
Urinary tract infection ¹	4 (4.4)	1 (1.1)
Impaired wound healing ²	4 (4.4)	4 (4.4)
Bleeding complications ³	2 (2.2)	0 (0)
Cardiologic complications ⁴	1 (1.1)	1 (1.1)
Total	11 (12.1)	6 (6.6)
P value	0,24	

¹ - leukocyturia and bacteriuria in the urine analysis performed in the perioperative period accompanied by dysuric symptoms and/or positive urine culture; ² - impaired wound healing and/or surgical site infection with or without abscess formation; secondary wound healing; ³ - excessive blood loss after surgery demanding transfusion or repeat surgical intervention; ⁴ - cardiac disorders which appeared in the perioperative period and demanded cardiac consultation and/or administration of cardiac medications

Table II. Selected data about diabetic patients who developed complications in the perioperative period.

No.	Age (years)	BMI (kg/m ²)	Gynecologic procedure	Complication	*Glycemia (mg/dl)
1.	55	26.0	Total abdominal hysterectomy	Urinary tract infection (<i>E.coli</i>)	101-130
2.	63	24.3	Cervical biopsy with D&C	Excessive bleeding from the cervix shield after intervention	100-130
3	41	46.0	Total abdominal hysterectomy	Excessive bleeding from surgical wound during and after surgery (red blood cells concentrate transfusion)	106-156
4.	72	33.0	Total abdominal hysterectomy	Wound infection (<i>S.aureus</i> , <i>E.coli</i>)	103-167
5.	63	44.0	Adnexectomy by laparotomy	Partial separation of the wound edges	121-180
6.	38	19.9	Hysteroscopy	Urinary tract infection (<i>K.pneumoniae</i>)	140-220
7.	72	40.0	Total abdominal hysterectomy	Wound infection (<i>P.mirabilis</i>)	116-174
8.	71	26.7	Transvaginal mesh	Urinary tract infection	100-134
9.	66	32.3	Total hysterectomy	Granulation tissue formation	120-178
10.	81	35.0	Total abdominal hysterectomy	Urinary tract infection	95-275
11.	78	25.2	Adnexectomy by laparotomy	Atrial fibrillation	104-159

* glycemia in perioperative period

Table III. Comparison of parameters of the perioperative period between the diabetic patients and corresponding controls.

Diabetic group vs control group				
Number of complications	Hb loss ¹	Temperature rise ²	Antibiotics ³	Length of stay in hospital ⁴
OR=1.83 CI=0.68-4.96 P=0.24	OR=0.89 CI=0.34-2.30 P=0.81	OR=0.73 CI=0.29-1.81 P=0.50	OR=1.18 CI=0.53-2.64 P=0.69	P=0.19

OR – odds ratio; CI – confidence interval; statistical significance at P<0.05; ¹ – Hb loss – hemoglobin loss after surgery of at least 1 g/dl compared to the hemoglobin level before surgery; ² – rise in body temperature above 37.5°C on postoperative day 2 or the following days; ³ – use of antibiotics postoperatively apart from standard perioperative antibiotic prophylaxis; ⁴ – length of hospital stay after the gynecologic procedure in days

Based on the literature, no definite conclusions can be drawn about the influence of diabetes on the perioperative period after gynecologic procedures. However, the majority of the studies proved diabetes to be a risk factor for perioperative complications [16, 18, 26-28] and only a few studies denied it [12, 13, 15, 29]. Lake et al., found diabetes to be a risk factor for SSI, but at the same time it was not related to higher risk of postoperative UTI [34].

Numerous factors could have influenced our results. Firstly, the study included only those patients who, according to the Polish Diabetes Association, had good diabetes control and in whom the diabetologist found no diabetic contraindications to the surgery [10]. Secondly, only patients who underwent elective surgery procedures were included in the study. If the cases of emergency surgery had been considered, the percentage of complications would have probably been higher. The results could have been also influenced by the fact that in the examined group of patients every woman received standard perioperative antibiotic prophylaxis and prophylaxis against thromboembolic complications. Besides, diabetic patients were evaluated by the diabetologist not only before the operation but also in the perioperative period if glycemia was unsatisfactory at that time. The results achieved in our study confirm the necessity of elective surgery in diabetic patients, as well as following the recommendations of the Polish Diabetes Association.

The fact that the selected parameters of the perioperative period did not differ significantly between diabetic and non-diabetic patients could have also been the effect of the postoperative observation time. In our study, patients were monitored until the discharge from the hospital (average hospitalization time was 11.5 days), whereas in some other studies the analysis of perioperative or early postoperative complications included at least 30 days [13, 15, 18, 28, 30-34]. Therefore, we cannot rule out the possibility that the percentage of complications in the examined patients would be higher with longer observation time. Besides, along with longer observation time, different complications could arise, e.g. none of the examined patients developed thromboembolic complications.

On the other hand, the evaluation of the patients after discharge from the hospital can be problematic. Environmental conditions which are unnaturally uniform in hospitals for all patients, become diverse after the discharge from hospital, and thus might become a factor that conditions the development of infection at home.

Glycemia is a well-known factor that determines perioperative prognosis. In our study, that factor was not analyzed statistically. Yet, the majority of diabetic patients (81.8%) in whom the complications occurred had normoglycemia in the perioperative period. Taking into consideration current studies, which underline the influence of hyperglycemia on surgery outcomes not only among diabetics but also among patients with normal glucose metabolism, measuring blood glucose in the perioperative period also in non-diabetic patients is worth considering [27, 28, 30]. However, this matter requires further research.

It must be emphasized once again that until now the majority of studies evaluating the relation of diabetes and perioperative outcomes have concerned cardiac surgery. In light of the growing awareness of the influence of diabetes on surgery outcomes, it is possible that new studies, focused directly on the relation

between gynecologic surgery and diabetes, will appear and will probably confirm the results obtained in our research.

Conclusion

The results obtained in our study allow us to draw two closely related conclusions:

- In the examined population of patients, diabetes was not an independent risk factor for perioperative complications.
- Good pre-operative glycemic control and strict cooperation between the diabetologist and the surgeon in the perioperative period result in the reduction of complications in diabetics, to the level typical for non-diabetic patients.

Oświadczenie autorów:

1. Joanna Świrski – autor koncepcji i założeń pracy, zebranie materiału, analiza i interpretacja wyników, przygotowanie manuskryptu i piśmiennictwa – autor zgłaszający i odpowiedzialny za manuskrypt.
2. Piotr Czuczwar – zebranie materiału, analiza i interpretacja wyników, analiza statystyczna wyników.
3. Agnieszka Żwolak – przygotowanie piśmiennictwa, korekta i aktualizacja literatury.
4. Beata Matyjaszek-Matuszek – autor założeń pracy, analiza i interpretacja wyników, przygotowanie, korekta i akceptacja ostatecznego kształtu manuskryptu.

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5. Ultrasonografia wieku dziecięcego - wskazówki praktyczne
6. Ultrasonografia w uroginekologii (panel wykładowo-ćwiczeniowy)

**Ultrasonografia 2D, 3D w onkologii i diagnostyce wad rozwojowych
(kurs wykładowo-ćwiczeniowy)
Poznań 9 września 2016 r.**

1. Sesja zaproszonych gości Gynecology – prof. Daniela Fischerova
How to scan gynecology ultrasound examination – lecture & live scanning
 - Scrying
 - Sterility
 - Post menopausal
 - Myoma, sarcoma and adenomyosis
 - Endometriomas and deep infiltrating endometriosis.
 - How to scan a patient with endometriosis
 - IOTA simple rules in classifying adnexal masses
 - Patient with ovarian malignancy
2. Sesja zaproszonych gości Perinatology – prof. Bernard Benoit
 - How to scan CUN – proactive guideless
 - Diagnosis of congenital malformation face and CUN
 - How to use 3D for clinical practice – live scanning
3. Ocena histopatologiczna raka jajnika i endometrium – co musimy wiedzieć i dlaczego – wskazówki praktyczne
4. Prezentacja ciekawych przypadków klinicznych
5. Praktyczne wskazówki obrazowania wad centralnego układu nerwowego oraz nowych technik 3,4D – schematy diagnostyczne (panel wykładowo-ćwiczeniowy)