

# Variation in repeat caesarean section complication rates among 3 hospitals in northern Jordan

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**التفاوت في مضاعفات العمليات القيصرية المتكررة، في ثلاثة مستشفيات في شمال الأردن**  
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**الخلاصة:** قام الباحثون باستقصاء معدل المضاعفات الناجمة عن الولادات القيصرية المتكررة في 3 مستشفيات (المستشفى الوطني، والمستشفى العسكري، والمستشفى الجامعي) في إربد، من خلال دراسة سجلات التوليد الخاصة بنحو 989 سيدة خلال المدة من 1 كانون الأول 1999 إلى 30 آذار/مارس 2004. وقد وجدت فروق يُعتدُّ بها إحصائياً من حيث عدد الولادات القيصرية السابقة والمستشفى الذي أجريت به. وقد كانت العملية القيصرية من النوع الاختياري عند 579 (58.5%) من السيدات. وكانت هناك فروق يُعتدُّ بها إحصائياً بين المستشفيات من حيث إخفاق تقدُّم المخاض كاستطباب لإجراء الجراحة القيصرية وفي غير ذلك من الاستطبابات. وبعد إجراء الضبط الذي يأخذ في الاعتبار عدد الجراحات القيصرية، كشف تحليل التحوُّف أن السيدات في المستشفيات العسكرية والمستشفيات الجامعية أكثر عرضة لحدوث المشيمة المنزاحة، في حين لا توجد أي فروق يُعتدُّ بها إحصائياً بين المستشفيات من حيث المضاعفات التالية للجراحة.

**ABSTRACT** We investigated the complication rates of repeat caesarean deliveries in 3 hospitals (national health, military, university) in Irbid by examining the obstetric records of 989 women from 1 December 1999 to 30 March 2004. There was a statistically significant difference between the number of previous caesarean sections and hospital. In total, 579 (58.5%) patients underwent elective caesarean section. There were statistically significant differences between hospitals for "failure to progress in labour" and "other" indications for caesarean section. After adjusting for the number of caesarean sections, regression analysis revealed that women from the military and university hospitals were more likely to have placenta praevia. There were no statistically significant differences between hospitals as regards post-operative complications.

Variation du taux de complications pour les césariennes itératives dans trois hôpitaux du nord de la Jordanie

**RÉSUMÉ** Nous avons étudié les taux de complications pour les césariennes itératives dans 3 hôpitaux (public, militaire, universitaire) à Irbid en examinant les dossiers obstétricaux de 989 femmes entre le 1<sup>er</sup> décembre 1999 et le 30 mars 2004. Il y avait une différence statistiquement significative entre le nombre des césariennes précédentes et l'hôpital. Au total, 579 patientes (58,5 %) ont subi une césarienne élektive. Il y avait des différences statistiquement significatives entre les hôpitaux concernant l'arrêt de la progression du travail comme indication de la césarienne et les « autres » indications. Après ajustement sur le nombre de césariennes, l'analyse de régression a montré que les femmes des hôpitaux militaire et universitaire étaient plus susceptibles de présenter un placenta praevia. Il n'y avait pas de différence statistiquement significative entre les hôpitaux concernant les complications postopératoires.

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## Introduction

Caesarean sections have for some time been performed with impunity. Such deliveries are associated with immediate and delayed morbidity and mortality risks [1]. Compared with vaginal deliveries, caesarean sections carry a higher number of postpartum complications [2]. During the past few decades the worldwide incidence of caesarean births has increased markedly [3]. Approximately 1 out of 4 women will have a caesarean delivery [4] and it is the most frequently performed surgical procedure in the United States [5]. Worldwide variation exists in rates for caesarean delivery [6]; currently the rates range from 10% to 40% of all deliveries [7].

Caesarean deliveries have come under scrutiny for more than a decade. The high rate of caesarean section poses a unique threat in the developing world where family size has not dipped to the low levels seen recently in the more industrialized countries. Numerous studies have shown variation in caesarean delivery rates by race, hospital type and hospital location [8–10]. The incidence in individual hospitals is dependent on the patient population [11].

About one-third of caesarean sections are repeat procedures [12]. In developing countries in general, and Middle Eastern countries in particular, the prevalence of women with multiple previous caesarean sections is high [13]. Repeat caesarean deliveries are associated with increased morbidity [14, 15] but little has been done to investigate complications that are specifically associated with repeat caesarean deliveries. The impact of the type of hospital on clinical outcomes has been examined for a variety of medical procedures [16]. Because little can be done to influence maternal factors that are associated with caesarean delivery complications [17], the

aim of this study was to describe the role that individual hospitals play in complications from repeat caesarean section. The hypothesis is that different types of hospital may have significantly different observed caesarean delivery complication rates. As part of an ongoing quality improvement project we investigated the variability in the rates of complications at 3 differently financed public hospitals in the city of Irbid, northern Jordan. Our objective was to assess the individual hospital contribution to intra- and post-operative repeat caesarean delivery complications and to measure their magnitude.

## Methods

We conducted a retrospective review of routinely collected admission data of all women with repeat caesarean section between 1 December 1999 and 30 March 2004. We did not apply any exclusion criteria. The settings were 3 public hospitals in the same city but which served different populations. The first, Princess Badea Teaching Hospital (PBTH), is a National Health Service maternity hospital open to the general population. The second, Prince Rashid Military Hospital (PRMH), is a general hospital open to military personnel and their families. The third, King Abdullah University Hospital (KAUH), is a semi-private university hospital open to insured university staff and their families, public service employees and cash payers. All hospitals have a 24-hour in-house attending specialist or faculty coverage, and most births are attended by residents with specialist or faculty supervision.

From the records of women with repeat caesarean sections performed at these hospitals over the study period, demographic data and significant aspects of the

medical history were extracted and the indications for repeat caesarean delivery were recorded. When more than 1 indication was found, a single main diagnostic variable was assigned for statistical analysis. Medical, ante- and intrapartum obstetric complications were identified, including pre-eclampsia, pre-existing and gestational diabetes, asthma, thyroid disease, placenta praevia, malpresentation, macrosomia, multiple gestation and placental abruption. The main outcome measures were intraoperative, immediate and short-term postoperative complication rates.

For each patient, outcome variables were recorded. These included haemorrhage (in excess of 800 mL) during the operation or in the puerperium, postoperative complications such as fever ( $> 38^{\circ}\text{C}$  on 2 consecutive measurements 6 hours apart other than in the first 24 hours), uterine fenestration, bladder injury, placenta praevia, placenta praevia accreta, intestinal or urinary tract problems, emergency peripartum and postpartum hysterectomy, incision cellulites, thrombosis, embolism, and intensive care admission.

Analysis of variance was used to test for the difference in maternal age, parity and gestational age between the 3 hospitals. Chi-squared test was used to analyse the distribution of caesarean section data. After adjusting for the number of previous caesarean sections, binary logistic regression was used to analyse the difference in complication rates between hospitals. A *P*-value  $< 0.05$  was used for the level of significance.

## Results

A total of 989 women underwent repeat caesarean section in the 3 hospitals in the study period: 679 at PBTH, 185 at PRMH and 125 at KAUH.

The demographic distribution of women according to hospital and clinical features, broken down by the number of repeat caesarean deliveries is presented in Table 1. There were no statistically significant differences between hospitals with respect to maternal age, parity or gestational age. Of the 989 patients reviewed, 480 (48.6%)

Table 1 Demographic and clinical characteristics of repeat caesarean section patients by hospital

Characteristic	PBTH (n = 679) Mean (SD)	PRMH (n = 185) Mean (SD)	KAUH (n = 125) Mean (SD)	P-value
Maternal age (years)	31.5 (4.3)	31.4 (4.5)	31.2 (4.1)	0.766
Parity	3.2 (1.7)	3.1 (2.6)	3.1 (1.3)	0.735
Gestational age (weeks)	36.5 (1.9)	36.6 (2.4)	36.8 (2.5)	0.321
No. of previous caesarean sections	No. (%)	No. (%)	No. (%)	< 0.001
1	351 (51.7)	56 (30.3)	73 (58.4)	
2	204 (30.0)	25 (13.5)	34 (27.2)	
$\geq 3$	124 (18.3)	104 (56.2)	18 (14.4)	

PBTH = Princess Badea Teaching Hospital; PRMH = Prince Rashid Military Hospital; KAUH = King Abdullah University Hospital.

SD = standard deviation.

Table 2 Indication for caesarean section in patients with 1 previous caesarean delivery by hospital

Indication	PBTH (n = 351) No. (%)	PRMH (n = 56) No. (%)	KAUH (n = 73) No. (%)	P-value
Fetal distress	59 (16.8)	4 (7.1)	13 (17.8)	0.162
Failure to progress in labour	97 (27.6)	14 (25.0)	7 (9.6)	0.04
Placenta praevia	11 (3.1)	1 (1.8)	4 (5.5)	0.471
Placental abruption	10 (2.8)	0 (0.0)	4 (5.5)	0.184
Malpresentation	47 (13.4)	12 (21.4)	9 (12.3)	0.246
Pre-eclampsia	34 (9.7)	3 (5.4)	6 (8.2)	0.558
Macrosomia	19 (5.4)	4 (7.1)	5 (6.8)	0.808
Multiple pregnancy	10 (2.8)	1 (1.8)	3 (4.1)	0.731
> 40 weeks gestation	21 (6.0)	0 (0.0)	5 (6.8)	0.127
Other	43 (12.3)	17 (30.4)	17 (23.3)	0.001

PBTH = Princess Badea Teaching Hospital; PRMH = Prince Rashid Military Hospital;  
KAUH = King Abdullah University Hospital.

had undergone 1 previous caesarean section, 263 (26.6%) had undergone 2 and 246 (24.8%) had undergone 3 or more. The proportion of women with previous caesarean section was not comparable in the 3 hospitals (low, 30.3% vs. high, 58.4% for 1 previous caesarean section), (low, 13.5% vs. high, 30.0% for 2 previous caesarean sections) and (low, 14.4% vs. high, 56.2% for 3 or more previous caesarean section) ( $P < 0.001$ ).

Of the total repeat caesarean deliveries, 579 (58.5%) patients underwent elective caesarean section. The KAUH caesarean section group had fewer patients undergoing elective caesarean section (61/125, 48.8%) compared to PRMH 97 (52.4%) ( $P = 0.530$ ) and PBTH 417 (61.4%) ( $P = 0.008$ ).

PRMH had fewer patients with the diagnosis of fetal distress (5/185, 2.7%) and PBTH had more patients with the diagnosis of failed trial of labour (97/351, 27.6%). The distribution of indications (only for patients

with 1 previous caesarean section for whom normal labour could be attempted) and the corresponding number of patients of the 3 hospitals are presented in Table 2. There were statistically significant differences between the hospitals as regards failure to progress in labour as the indication for caesarean section and "other" indications.

The details of the postoperative maternal complications according to the number of caesarean sections are presented in Table 3. Generally, there was a decrease in the incidence of operative haemorrhage in women with higher number of previous caesarean sections. There was a difference between hospital rates for haemorrhage, especially for cases with 2 previous caesarean sections (low 7.3% vs. high 24.0%). However, analysis for this group and for women with 1 previous caesarean (low 14.8% vs. high 26.0%) and 3 or more previous caesarean sections (low 10.5% vs. high 18.5%) were not statistically significant.

Table 3 Caesarean section findings and postoperative complications by hospital and number of previous caesarean sections

Complication	Previous caesarean sections No.	PBTH No. (%)	PRMH No. (%)	KAUH No. (%)
Placenta praevia	1	8 (2.3)	5 (8.9)	1 (1.4)
	2	2 (1.0)	2 (8.0)	1 (2.9)
	≥ 3	4 (3.2)	16 (15.4)	2 (11.1)
Uterine fenestration	1	3 (0.8)	2 (3.6)	2 (2.7)
	2	3 (1.5)	2 (8.0)	1 (2.9)
	≥ 3	4 (3.2)	3 (2.9)	1 (5.6)
Haemorrhage	1	52 (14.8)	12 (21.4)	19 (26.0)
	2	15 (7.4)	6 (24.0)	3 (8.8)
	≥ 3	23 (18.5)	11 (10.6)	2 (11.1)
Hysterectomy	1	0	0	1 (1.4)
	2	2 (1.0)	0	0
	≥ 3	4 (3.2)	2 (1.9)	0
Fever	1	7 (2.0)	1 (1.8)	2 (2.7)
	2	0	3 (12.0)	1 (2.9)
	≥ 3	8 (6.4)	6 (5.7)	0
Wound infection	1	7 (2.0)	1 (1.8)	2 (2.7)
	2	2 (1.0)	0	0
	≥ 3	5 (4.0)	7 (6.7)	0
Visceral injuries	1	1 (0.3)	1 (1.8)	0
	2	2 (1.0)	0	0
	≥ 3	2 (1.6)	2 (1.9)	0

PBTH = Princess Badea Teaching Hospital; PRMH = Prince Rashid Military Hospital; KAUH = King Abdullah University Hospital.

Percentages calculated from total for each hospital for number of previous caesarean sections.

There were 41 (4.1%) cases of placenta praevia in the women from the 3 groups. There was an increased incidence of placenta praevia in relation to higher number of previous caesarean sections. There was 1 death of a mother with 3 previous caesarean sections and placenta praevia accreta. She died a few hours after undergoing caesarean hysterectomy. The cause was shock that could not be reversed.

Nine (0.9%) women required caesarean hysterectomy. Placenta praevia accreta was present in 6 of these women, 1 woman had hysterectomy with a normally sited placenta accreta, 1 was due to intraoperative atonic bleeding, and another was due to postoperative atonic bleeding of more than 1500 mL and severely lacerated uterine wound margins.

Eight (8) women had visceral injuries: 5 had bowel injury and in 3 the urinary bladder was attached high on the anterior abdominal wall where it was inadvertently entered and was repaired. There were 21 cases of uterine scar fenestration. The risk of fenestration did not seem to be affected by the number of previous caesarean sections. There were no cases of uterine rupture, thromboembolic events, anaesthetic complications or patients needing intensive postoperative care. One maternal death was recorded. The aggregate rate for analysed potentially avoidable complications of haemorrhage, hysterectomy, fever, wound infection and visceral injuries for the 3 hospitals in this study was 21.4% (212 complication/989 caesarean sections).

Binary logistic regression analysis revealed that women from PRMH (odds ratio = 3.66) and KAUH (odds ratio = 3.41) were more likely to have placenta praevia compared to women from PBTH after adjusting for the number of caesarean sections. Odds ratios for postoperative maternal complications (adjusted for the number of caesarean

sections) and their 95% confidence intervals for women from PRMH and KAUH compared to women from PBTH are presented in Table 4. There were no statistically significant differences between the hospitals with regard to any of the postoperative complications.

## Discussion

Giving birth is a ubiquitous event that usually occurs in a hospital setting. It has been calculated that the average woman in developed countries will have 3.3 pregnancies resulting in 2.1 live births [17]. Hospital births represent 12% of all hospitalizations [18]. Although patients presenting with 3 or more previous caesarean sections is not a common event in the industrialized world, its prevalence in developing countries is common [19,20]. This indicates the obvious importance of analysing the clinical outcomes of repeat caesarean deliveries. Teaching hospitals have lower unadjusted caesarean rates compared with other com-

Table 4 Logistic regression analysis (adjusted for caesarean section) for repeat caesarean section and caesarean section findings and postoperative complications

Complication	PBTH (n = 679)				KAUH (n = 125)		
	OR	OR	95% CI	P-value	OR	95% CI	P-value
Placenta praevia	1	3.66	1.71–7.84	0.001	3.41	1.39–8.38	0.101
Haemorrhage	1	1.20	0.74–1.94	0.470	1.52	0.09–2.51	0.101
Hysterectomy	1	0.59	0.11–3.13	0.533	1.05	0.12–8.92	0.964
Fever	1	0.74	0.31–1.71	0.481	1.20	0.34–4.28	0.771
Wound infection	1	1.41	0.54–3.65	0.477	0.78	0.17–3.53	0.758
Visceral injuries	1	1.58	0.32–7.63	0.567	– <sup>a</sup>	– <sup>a</sup>	– <sup>a</sup>
Uterine fenestration	1	2.26	0.78–6.52	0.133	2.30	0.71–7.49	0.165

PBTH = Princess Badea Teaching Hospital; PRMH = Prince Rashid Military Hospital; KAUH = King Abdullah University Hospital.

OR = odds ratio; CI = confidence interval.

<sup>a</sup>OR were not calculated because the numbers were small.

munity hospitals [21]. Significant variations may be justified when individual hospitals serve different populations with varying risks. As a clinical measure of quality of care, studying the variations in rates among hospitals, especially those that are in the same area, may uncover inherent institutional clinical differences in caesarean delivery complication rates.

Our elective repeat caesarean delivery rate was similar to that reported by other studies [22–25] and represents the largest contribution to the repeat caesarean delivery rate. Patients' preference plays a significant role within this elective caesarean section group [26]. Failure to progress in labour was an indication for repeat caesarean section in 27.6% of patients at PBTH, 25.0% at PRMH and 9.5% at KAUH. Although not all patients who undergo a scheduled repeat caesarean delivery are candidates for a trial of labour, some patients in the elective group could have been allowed a trial of labour. This would have potentially decreased the repeat caesarean delivery rate and the possible complications. This probably reflects both patient and physician attitudes toward vaginal birth after caesarean section. They may be reluctant to attempt a trial of labour when the fetus in a subsequent pregnancy is presumed larger. Macrosomia was an indication for a second caesarean section in 5.8% of women in our study. A study by Zelop et al. demonstrated that a trial of labour after previous caesarean delivery may be a reasonable clinical option for pregnant women with suspected birth weights of > 4000 g, given that the rate of uterine rupture associated with these weights does not appear to be substantially increased when compared to lower birth weights [27]. However, some caution may apply when considering a trial of labour in women with infants weighing > 4250 g. A trial of labour may also be

reasonable in women whose previous caesarean was for dystocia in the second stage of labour. It has been demonstrated that patients who underwent a trial of labour after a previous caesarean for dystocia in the second stage had a 75% chance of achieving vaginal delivery [28].

There is a strong relationship between hospital volume and complications of delivery; the likelihood of complications decreases as volume increases [8]. A high volume institution, which in this study was PBTH, may perhaps serve a demographically distinct population. Adjusting for case mix enables improved identification of hospitals with caesarean delivery complication rates significantly lower or higher than others [29]. For comparison across hospitals some studies have used multivariate regression techniques to "adjust" for differences, taking into consideration multiple co-morbidities [30,31]. In our study, we used binary logistic regression after adjusting for the number of previous caesarean sections to analyse the difference in complication rates between hospitals. Except for placenta praevia, which is not an avoidable complication, we found no significant difference in observed caesarean delivery complication rates between the 3 hospitals covering 3 different population sub-groups of the same region. If 1 of these hospitals was found to have the best practice results for an avoidable complication, then risk adjustment could be based on that hospital's data. Failing this, aggregate regional results can be used to provide the initial criteria. The overall rate for potentially avoidable complications (haemorrhage, hysterectomy, fever, wound infection and visceral injuries) for the 3 hospitals in this study was 20.6%, with no statistically significant difference between the hospitals. Therefore, no clear consensus exists regarding which clinical,



demographic or hospital factor should serve as a model.

Although our study does not suggest an accepted average rate for caesarean section complications, the wide variability observed within each risk category, suggests that surgery is often inappropriately used. In our study "other" was one of the variables that was significantly different between hospitals. Under this category we included all indications that were not on the

study list of parameters. The data suggest, above all, that caesarean section is often practised when it is not clearly indicated. These circumstances make it necessary to devise interventions for the selective reduction of complications. Work in this area includes systematic review of all available evidence and research to increase the body of available evidence. Currently, the various practices considered appropriate are at the discretion of the clinician.

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