

## Operator Experience and Patient's Morbidity in Cesarean Section Deliveries

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**Objective:** To evaluate the relationship between the operator experience and postoperative morbidity rate and to analyze the effect of residency level on the length of the operation time, hospital stay and the rate of reoperation.

**Design:** A Retrospective Study.

**Setting:** Obstetrics and Gynecology Ward, Bahrain Defense Force Hospital, Bahrain.

**Method:** All patients who had cesarean section between January 2017 to March 2017 were included in the study. The operator experience levels were divided into two groups: consultants/ chief resident and senior/junior residents. The lower segment cesarean section difficulty levels were divided into three groups: high, medium and low. The study outcomes were the length of the operation time, hospital stay and rate of reoperation.

**Result:** There was no difference in the difficulty level between the two groups. There was no difference in general anesthesia usage between the groups. There were significantly more senior assistants with the senior operator compared to the junior group. Surgical duration for junior operator was significantly longer than the senior operator. There were more blood transfusion and drainage use in the junior group, but the difference was not statistically significant. There was no difference in hospital stay, Hb drop, the need for multi-disciplinary team and complication rate between the two groups.

**Conclusion:** Junior resident participation does not negatively affect outcomes in patients undergoing cesarean deliveries.

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Cesarean delivery is the most commonly performed surgery in the United States<sup>1</sup>. The rate of cesarean deliveries has continued to rise worldwide, reaching an all-time high of 32.8% in 2010<sup>1</sup>. Cesarean section can be done for maternal or fetal reasons. Maternal indications may include cephalopelvic disproportion, multiple pregnancies, failed induction of labor, preeclampsia, repeat cesarean section, maternal infection (HIV and HSV), placenta previa grade 4, abruptio placentae, prolapsed cord, uterine deformity and heart disease. Fetal indications may include fetal distress, abnormal position, isoimmunization and congenital anomalies.

Despite the high rate of C-section, the risk of mortality and morbidity is still high. There is a 2-fold increase in maternal mortality and morbidity with cesarean compared to vaginal delivery<sup>1</sup>. Surgical complications of C-section can be intra-operative and post-operative. The complication could be bleeding and injury to the nearby organs, such as the bladder and the bowel. A study showed that approximately 12% of the cases who had C-section delivery had cesarean complications<sup>2</sup>. The severity of blood loss during the procedure correlates to the speed of controlling the blood loss, which is directly related to the operator experience. Furthermore, recognizing anatomy and handling tissue with care is essential to prevent avoidable organ damage.

Postoperative complications may include postpartum hemorrhage (9.2%), wound infection (6%), endometritis (6%), UTI (6%) and fascial dehiscence, which could develop

in approximately 5% of the patients<sup>3</sup>. Thromboembolic complications are also increased in cesarean delivery. The risk for developing a thrombus is increased 3- to 5-fold with a cesarean delivery<sup>3</sup>. The occurrence of this complication is possibly influenced by the complexity and length of the procedure. A study showed that most of the readmissions occurred within 30 days after cesarean deliveries compared to vaginal deliveries<sup>4</sup>.

Surgical residents at different levels of residency provide care to patients and therefore play a key role in the quality of care. To become a highly skilled surgeon, residents complete many years of education and training to diagnose, treat patients and perform complex cases. This leads some to wonder, what is the impact of having residents participating in patient surgical management?

It is currently unknown whether resident involvement increases maternal morbidity in patients undergoing multiple repeat cesarean deliveries because the studies of the relationship between cesarean delivery and mortality have yielded inconsistent results and those types of studies were limited<sup>2</sup>.

The main purpose of this study is to evaluate the relationship between the operator experience and postoperative morbidity rate. The study will also analyze the effect of residency level on the length of the operation time, hospital stay and the rate of reoperation.

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**METHOD**

All patients who had cesarean section between January 2017 to March 2017 were included in the study. The variables documented included date of admission, date of discharge, operation start/ends time, cesarean type (emergency or elective procedure), indications, the main operator level of seniority, assistant experience, type of anesthesia, use of postoperative drain, hemoglobin level pre/post operation, the need for blood transfusion, the need for multi-disciplinary team during procedure and other complications such as wound infection, reoperation, readmission and mortality.

The operator experience levels were divided into two groups: consultants/chief resident (senior operator) and senior/junior residents (junior operator). Our hospital runs on both trainee and service operator. All senior operators in this study include fully trained surgeon. However, some junior operators doing service job are well experienced surgically. The lower segment cesarean section difficulty levels were divided into high, medium and low based on recorded indications and level of experience required. Low difficulty group cesarean includes elective first cesarean, breech presentation, fetal distress, Premature Rupture of Membranes (PROM), Intrauterine Growth Restriction (IUGR) or failed induction of labor. Medium difficulty group includes repeated C-section up to previous two cesareans, twin pregnancy and emergency cesarean under general anesthesia. High difficulty group includes patients with abnormal placenta location, placenta abruption, classical/hysterotomy incisions, previous high order cesarean section, cord prolapse and failed instrumental deliveries.

Patient post-cesarean delivery stays between 2-3 days in our hospital. We analyzed total hospital stay from admission date. Documented surgical timing from knife to skin closure. HB drop was calculated from the difference between admission and postoperative levels. HB levels are usually checked on the second-day post procedure.

All patients who had cesarean section between January 2017 to March 2017 were included in the study. All patients during the study period had full record, therefore, no case had to be excluded from the study.

Data was compiled on Microsoft Excel and analyzed using StatsDirect statistical package (version: 3.0.141). Unpaired T-test was used to compare means of surgical duration. Mann-Whitney U test was used to compare medians of length of hospital stay and HB drop. Chi-square test in crosstabs was used to compare the type of cases and assistant level. Fisher-Freeman-Halton exact in crosstabs was used to compare case difficulty, type of anesthesia, blood transfusion, usage of drain, the need of multi-disciplinary team and complications as a cell in crosstabs have an expectation of less than 5. P-value of less than 0.05 was considered as statistically significant.

**RESULT**

During the study period, 278 cesarean deliveries were delivered. Two hundred four (73.4%) were performed by junior operators. Most cases performed by junior operators were emergency, 124 (44.6%) and most cases performed by senior operators were elective type, 50 (17.9%), P<0.0001. No difference was found in the difficulty level between the two groups P=0.14. Similarly, there was no difference in general anesthesia usage between

senior, 1 (0.4%), and junior, 9 (3.2%), P=0.29. There were significantly more senior assistants with the senior operators, 19 (6.8%) compared to 21 (7.5%) senior assistant for the junior group P=0.001, see table 1.

**Table 1: Procedure Characteristics**

	Senior Operator	Junior Operator	P-value
<b>Type of case</b>			
Emergency cases	24 (8.6%)	124 (44.6%)	<0.0001***
Elective cases	50 (17.8%)	80 (28.8%)	
<b>Case difficulty</b>			
Low	25 (8.9%)	95 (34%)	0.14****
Medium	47 (16.9%)	102 (36.7%)	
High	2 (0.7%)	7 (2.5%)	
<b>Type of anesthesia</b>			
Spinal anesthesia	73 (26.3%)	195 (70.1%)	0.29****
General anesthesia	1 (0.4%)	9 (3.2%)	
<b>Assistant level</b>			
Junior	55 (19.8%)	183 (65.8%)	0.001***
Senior	19 (6.8%)	21 (7.5%)	

\*\*\*Chi-square \*\*\*\* Fisher-Freeman- Halton exact

The procedure duration for the junior operators was significantly longer than the senior operators, 52 minutes compared to 45 minutes, respectively (P-value=0.002). There was more blood transfusion and drainage use in the junior group; however, the difference was not statistically significant. Similarly, there was no difference in hospital stay, Hb drop, the need for multi-disciplinary team and complication rate between the two groups, see table 2.

**Table 2: Operative Outcome**

	Senior Operator	Junior Operator	P-value
<b>Surgical Duration minutes mean ± SD</b>	45± 16	52± 17	0.002*
<b>Hospital stay days median (range)</b>	5.4 (11-3)	5.6 (15-3)	0.53**
<b>HB drop median ( range)</b>	0.6 (2.8-0)	0.7 (4-0)	0.23**
<b>Blood transfusion</b>	1 (0.4%)	4 (1.4%)	>0.99****
<b>Need multi-disciplinary team</b>	0 (0%)	1 (0.4%)	>0.99****
<b>Usage of drain</b>	3 (1.1%)	9 (3.2%)	>0.99****
<b>Complications</b>	2 (0.7%)	4 (1.4%)	0.66****

\*Unpaired T-test \*\* Mann-Whitney U test \*\*\*\*Fisher-Freeman-Halton exact

**DISCUSSION**

A systematic review of the effects of residency training on patient outcomes showed that a senior operator has a better outcome and higher satisfaction compared to a junior operator<sup>5</sup>. Contrary to these findings, our analysis found that junior operator involvement does not negatively affect outcomes in patients undergoing cesarean deliveries. Similar findings were reported in other studies, where they found no effect of

resident involvement on patient outcome in vascular surgeries and coronary artery bypass surgeries respectively<sup>6,7</sup>. Faisal et al found that residents were more likely to have higher-risk and urgent coronary artery bypass surgeries than consultants or chief surgeon. We also noted that most of the low/medium difficulty, urgent or emergency cases were performed by the junior operator, and that reflect the availability of the junior operator on the labor room for emergency conditions.

A study reported more complications with seniors and they pointed to the fact that more difficult operations were performed by the seniors. However, that study had no specific difficulty level assessment<sup>5</sup>. Another study on the effect of resident experience on the outcome of coronary artery bypass surgery, pointed to similar surgical outcome because juniors operate on low-risk cases<sup>6</sup>. Renwick et al analyzed the effect of supervised surgical training on the outcome after resection of colorectal cancer and found no difference between the consultant and trainees in a supervised training program. They recorded advanced tumors in the supervised training group<sup>8</sup>. This finding is merely due to the fact that difficult cases in this study are done in the public hospital where trainee will be encountered during procedure. Cases by consultants are mainly performed in private settings with less access to training<sup>8</sup>. In a retrospective study on surgical outcome based on resident involvement in vascular surgery, the author reported higher preoperative pneumonia, cerebral vascular accident, dialysis and smoking in cases done by seniors<sup>7</sup>.

Elena Igwe studied the effects of resident involvement on operative times in patients undergoing laparoscopic hysterectomies for benign conditions; no difference of procedure time was found between junior and senior resident<sup>9</sup>. However, the group found prolonged surgery performed by resident compared to surgery by the attending physician<sup>9</sup>. Another study evaluated the impact of resident involvement in vascular surgery revealed longer operative time for surgeries done by resident even though their patients had less preoperative risk factors<sup>7</sup>. Andrew et al evaluated the effect of resident participation in short-term outcome after orthopedic surgery and found that senior operator had significantly shorter operative times in all procedure domains<sup>10</sup>. We found that the absolute difference in mean operative time between the senior and junior groups was only seven minutes, which did not increase the wound complications or maternal infection. The seven minutes' difference in time between the 2 groups might be attributed to the experience of the senior operator. Moreover, most of the elective surgery is performed during the availability of the consultants in a more controlled environment where all experience affiliate teams are available in short period of time. The length of the procedure would have a direct effect on possible postoperative morbidity. Ravi et al evaluated the impact of resident participation in surgical operations on postoperative outcomes; cases with resident participation had statistically longer operative time and that reflected in higher surgical site infection<sup>11</sup>.

In the study by Faisal et al about the effect of resident's experience and outcomes of coronary artery bypass surgery, they found that the level of the operator does not affect the length of hospital stay, which is similar to our findings<sup>6</sup>. On the other hand, two studies had different results<sup>7,10</sup>. They found that the training level affects the length of hospital stay of which it is prolonged in those with less training.

We evaluated the use of postoperative drainage and noted a higher number of usage by the junior team, but the difference was not statistically different. The use of drainage by juniors could reflect the feeling of less secure about the procedure. Also could be due to the comforting sentiment of having direct access to any post-surgery bleeding.

Most of the studies which looked at the involvement of juniors pointed to more morbid or complicated cases operated by seniors. This fact will make interpretation of those studies very intricate<sup>12</sup>. Systemic analysis pointed to a higher rate of preventable morbidity and fatal medications errors at the beginning of the academic year compared to later on<sup>5</sup>. The study also pointed to modest elevation of blood loss and higher morbidity rate for patients looked after by residents working without supervision<sup>5</sup>. Another study found a higher rate of readmission, blood transfusion, and reoperation in surgeries performed by resident compared to attending physicians<sup>9</sup>. One study focused on difficult cases by looking at high-order cesarean deliveries only. The study found longer operating time in the resident group but no difference in measured outcomes in the form of wound complications, blood loss, blood transfusion, major maternal morbidity (hysterectomy, cystotomy, bowel injury, intensive care unit admission, thrombosis, reoperation, death), postoperative endometritis, and postoperative days in the hospital<sup>1</sup>.

A retrospective analysis of oncology procedure found higher postoperative complication rate in the non-trainee group. Though, the study points to a higher postoperative infection in the trainee group<sup>13</sup>. Similarly, a systemic review about the influence of training programs in the learning curve of laparoscopic gastric bypass for morbid obesity found more frequent postoperative complications in the non-trainee group<sup>14</sup>. Our study found higher blood transfusion and complications in the junior group but these findings did not reach statistical significance.

Our study is limited by its retrospective design. The collection of data was restricted to what was recorded in the file. Our classification of difficulty level did not include factors, which might increase the surgical risks, such as maternal age, BMI or number of previous deliveries because most of our patients underwent less than 4 cesarean deliveries. The accuracy in classifying cesarean section difficulty level based on its categories could be deceptive as well. It is well-known that indications per se would not automatically reflect the difficulty level. For example, an obese patient having an elective cesarean for breech delivery might be more difficult than straight forward high order repeated emergency cesarean on a slim woman. Another limitation of this study is the difficulty in determining accurately the real contribution of the two operators in the cesarean section. It is also difficult to determine the number of surgeries performed previously by the residents which will obviously affect the seniority level. Our patient population was mostly having free health services so all procedure was performed using similar operative technique with minimal variation in clinical practice. Further prospective studies across the country with a larger sample size could help determine whether our findings could be reproduced.

## CONCLUSION

**Resident involvement in cesarean delivery does not appear to increase the risk of adverse outcomes. Residents should**

**be included in more complicated cases since they can obtain a significant learning experience without compromising patient safety.**

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**Competing Interest:** None.

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