Effect of Different Work-time Periods on the Incidence of Post-Dural Puncture Headache in Cesarean Section Patients at King Abdullah University Hospital

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Abstract

Background: Post-dural puncture headache (PDPH) is a known incapacitating complication after dural puncture. There are many risk factors for the development of this complication. Night work time is associated with sleep interruption and exhaustion with consequent work incidents. The effect of night time work on development of PDPH is speculative and non-conclusive so far. The aim of this study was to test this work time effect on obstetric ward.

Methods: In this prospective observational study at a university hospital, we compared the incidence of PDPH in parturient women undergoing spinal anesthesia for caesarean section based on different work-time periods. Using standard diagnostic criteria, patients were followed up to five days postoperatively using clinical visits and phone calls. Working time was further tested as a risk factor for the development of PDPH using appropriate statistical techniques.

Results: Patients were comparable between the two work time groups in their demographic, obstetric, and procedure profiles (P>0.05). The overall incidence of PDPH was 26% (44/167). The on-call work period group had a significantly (P<0.05) higher incidence of PDPH compared to day time group: 40% (17/42) vs 21.6%(27/125), respectively. Regression analysis showed that work time was also a significantly correlated risk factor with PDPH (OR=2.58, CI 1.07-6.23, P<0.05).

Conclusions: our study has shown that caesarean section under spinal anesthesia during on-call period is associated with higher incidence of PDPH than those at day time period. Specially designed studies are encouraged to search for the underlying cause of this difference.

Keywords: Headache, Dural puncture, Caesarean section, Obstetrics, Work time.

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Introduction

Post-dural puncture headache (PDPH) is a common and potentially incapacitating complication of neuraxial anesthesia.[1] The pathophysiology of PDPH is based on the theory that excessive leakage of cerebrospinal fluid (CSF) can occur through the dural

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puncture site. This is expected to lead to a state of decreased CSF volume and intracranial hypotension. The possible consequent stretching of pain sensitive intracranial structures is believed to be the direct cause of PDPH.[2]

Risk factors for the development of PDPH are multiple and have been extensively studied.[3,4] Identified risk factors include female gender, young age group, previous PDPH, large needle size, and bevel orientation. Night work, with its consequent sleep disruption and operator fatigue has been considered a risk factor for the development of PDPH.[5,6] However, despite cumulative evidence of fatigue-related errors in medical practice, the evidence of the effect of night work on the development of PDPH is still speculative and non-conclusive at its best.

The aim of this prospective observational study was to assess the significance of puncture time as one of the risk factors for the development of PDPH in obstetric patients undergoing caesarian section under spinal anesthesia.

Materials and Methods

This prospective study was conducted at King Abdullah University Hospital, Ramtha, Jordan in the period from February to June, 2012. After approval from the local institutional review board (IRB), all pregnant women undergoing caesarian section under spinal anesthesia were considered for enrollment in the study. Verbal consent was sought from each parturient after all contraindications for spinal anesthesia were excluded. Consenting patients were informed about the study's postoperative daily follow up protocol by an anesthetist and a post-discharge phone call repeated as necessary.

Data collection for each case was started at the end of cesarean section. The following variables were obtained: parturient's demographics (i.e. age, weight, height, and BMI), gestational age, parity, presence of pre-eclampsia during current pregnancy, previous spinal anesthesia and if yes, previous experience of PDPH. Other history variables included history of sinusitis, migraine, and caffeine intake (>3 cups of coffee/day). Operator and procedure related variables obtained were level of operator experience (training year and number of spinals done before), type and size of spinal needle, number of dural puncture attempts, and time of spinal anesthesia. The obstetric team members who were aware of the study purpose were asked to report the occurrence of any postoperative headache to our team which then followed up the patient. The headache was diagnosed as PDPH if it fulfilled the International Classification of Headache Disorders, 3rd edition (Beta version) criteria (ICHD-III beta): (i) dural puncture has been performed; (ii) headache has developed within 5 days of the dural puncture, (iii) not better accounted for by another ICHD-III beta diagnosis[7] Patients who undergo uncomplicated caesarian section in our hospital are usually discharged home on the third postoperative day. So we asked patients to report to us any complaint of headache after being discharged home. Also, a phone call on the fifth postoperative day was made by one of our research team members to each woman investigating whether she had any headache complaints.

The on-call assignment in our hospital is 24 hours long. Day time work starts at 08:00 AM and ends at 04:00 PM. Those anesthetists who are on-call will continue their work doing any required anesthetic cases till 08:00 AM next morning. Accordingly, we divided the work

time according to the end of elective and start of on-call working hours in our hospital into two parts for the sake of data analysis: Day-time (DT) from 8:00 AM to 4:00 PM, and on-call time period (OCT): 4:00 PM – 8:00 AM. The occurrence of PDPH was the primary outcome in our study. Exposures of interest included all of the above mentioned variables related to parturient demographics, obstetric history, medical history, and operator and procedure related factors. The effect of work time on the incidence of PDPH was then tested first by comparing the two work time groups in terms of exposures of interest and incidence of PDPH. Then, the work time group was included with other exposures of interest and tested as an independent variable for the development of PDPH

Patients' demographics were summarized by descriptive statistics using mean ± SD for continuous variables and frequencies for categorical ones. Chi square (χ^2) test and independent groups t-test were used to compare variables between the two study groups as appropriate. The associations of independent variables with the dependent one (PDPH) were analyzed using binary logistic regression.

Results

Over the study period, 620 parturients gave birth in our hospital. Delivery was through caesarian section in 279 cases (45%). Of these caesarians, 167 cases were carried out under spinal anesthesia (65%). One hundred and twenty five spinal cases were done during day time and 42 spinals during the on-call period. All spinal anesthesia cases were enrolled in the study without consequent withdrawals. All spinal blocks were carried out in the sitting position using only cutting-beveled 25G Quincke spinal needle. One case was converted to general anesthesia due to inadequate spinal block. Patients were comparable between the two work time groups in their demographic, obstetric, and procedure profiles (Table 1).

Table 1. A comparison of demographic, obstetric, and procedure profiles between day time (DT) and on-call work-time (OTC) groups of study patients

Variable	DT Group N=125	OCT Group N=42	P-value
Age (yr) *	31.7 ± 5.4	32.8 ± 4.9	0.233
Weight (kg) *	83.5 ± 11.5	81.7 ± 8.8	0.368
Height (cm) *	167.5 ± 6.2	168.8 ± 4.8	0.246
Gravida *	3.4 ± 2.1	3.2 ± 2.4	0.609
Parity *	1.7 ± 1.4	1.6 ± 1.6	0.552
Previous spinal block **	35 (28%)	7 (16.7%)	0.134
Past PDPH **	10 (8.1%)	1 (2.4%)	0.201
Pre-eclampsia **	5 (4.0%)	1 (2.4%)	0.626
History of migraine **	8 (6.4%)	3 (7.1%)	0.867
Operator level of practice (yr)*	2.2 ± 0.43	2.1 ± 0.26	0.092
Number of attempts*	1.5 ± 1.01	1.5 ± 1.03	0.819

DT: Day Time, OCT: On-Call Time. *Values are Mean ± SD. **values are frequency (percentage)

The overall incidence of PDPH was 26% (44/167). Within study groups, 27 women in group DT (21.6%) developed symptoms of PDPH compared to 17 (40%) in OCT group. The difference between the two groups was statistically significant (P<0.05). There was no difference in onset time neither of PDPH nor of its duration between the two work time groups. The number of PDPH case requiring analgesic treatment was also comparable in both time groups (Table 2).

Table 2. Incidence and charteristics of PDPH based on work-time period

	Day-time period N=125	**On-call Period N=42**	**P value**
PDPH**	27 (21.6)	17 (40.4)	0.016$^{\Psi}$
Headache start, days*	2.67 ± 1.1	2.88 ± 1.1	0.541
Headache duration, days*	2.6 ± 2.4	2.4 ± 1.3	0.695
Analgesia required for PDPH**	10 (58.8)	7 (42.2)	0.108

* Values are Mean ± SD, **values are frequency (percentage), $^{\Psi}\chi^2$ test.

Table 3. Results of binary logistic regression analysis of variables in study participants as risk factors for the development of PDPH

Independent variable	**Adjusted odds ratio**	**95% confidence interval**		**P-value**
		Lower	**Upper**	
Age	1.02	0.942	1.105	0.628
Weight	1.01	0.967	1.055	0.66
Height	0.982	0.956	1.009	0.196
Gravidity	1.138	0.848	1.529	0.389
Parity	0.87	0.56	1.352	0.537
Previous Spinal	0.855	0.298	2.452	0.771
Previous Headache	0.434	0.043	4.386	0.479
Pre-eclampsia	0.567	0.05	6.46	0.648
Migraine	0.345	0.038	3.107	0.342
Caffeine withdrawal	0.518	0.137	1.962	0.333
No. attempts	0.763	0.468	1.243	0.277
Level of practice	0.85	0.386	1.869	0.686
Work-Time Group	2.58	1.069	6.229	0.035

Table 3 shows the results of binary regression analysis of the association of independent factors with the development of PDPH. Except for time of work (P<0.035), all other factors were not associated with PDPH risk.

The average times at which caesarean sections were carried out were 11:28 AM (08:00 AM – 03:40 PM) for the DT group, and 08:52 PM (04:00 PM – 07:30 AM) for the OCT group. The percentage of emergency C/S

in OCT study group was significantly (P<0.001) higher than that in the DT group; 22/42 (52.4%) vs. 27/125 (21.6%), respectively. The incidence of PDPH was compared between elective and emergency procedures and found to be statistically (P=0.70) comparable; 30/118 (25.4%) vs 14/49 (28.6%), respectively.

Bed rest and increased oral fluid intake were adequate treatment modalities in 27 patients. Paracetamol (1 gm PRN) was added in another 11, and advice to increase intake of caffeine containing drinks in the remaining 6 patients. None of the patients who developed PDPH required epidural blood patch.

Discussion

The focus of our study was the effect of working time on the incidence of PDPH. For this purpose, we chose pregnant women undergoing caesarian section under neuraxial anesthesia as homogeneous group of participants with common occurrence of the problem.[8] This study population is characterized by the concurrent presence of multiple risk factors for the development of PDPH. In addition to their gender and young age, these women are exposed to widespread application of neuraxial anesthesia on all-hour basis.[5] In fact, PDPH was found to be the third most common reason for litigation in obstetric anesthesia in the closed claims analysis carried out by the American Society of Anesthetists (ASA).[9] General anesthesia for caesarean section is reserved nowadays mainly for true emergency cases where there is insufficient time for regional technique.[10]

Our study results showed that on-call period is associated with a higher incidence of PDPH in obstetric patients undergoing spinal anesthesia for caesarean section. This is consistent with the concept of effect of fatigue and sleep deprivation on operator performance. However, it was reported that sleep deprivation and fatigue do not affect the overall performance of anesthetists despite negative effects on their psychomotor performance and mood.[7,11] In the field of epidural anesthesia, the results of research about the effects of night work on the incidence of dural puncture and PDPH are conflicting. While one study showed a higher incidence of unintentional dural puncture during obstetric epidural anesthesia,[12] another prospective study showed lack of effect of sleep deprivation on labor epidural catheter placement.[7] In spinal anesthesia, a recent study by Park et al. assessing the significance of puncture time for the development of PDPH in patients undergoing lumbar puncture for diagnostic purposes, found a lower incidence of PDPH in patients whose punctures were performed at night time.[13] However, No similar studies were carried out to test the reproducibility of these results in obstetric patients undergoing caesarian section under spinal anesthesia. In their retrospective study, Park et al. recruited heterogeneous group of patients presenting for diagnostic purposes.[13] The night work time in their study was defined as any time after 08:00 PM without mentioning the range. The non-emergent nature of the procedure indicates that neither the patient nor the operator was under stress or having any sleep interruption as is the case in obstetric anesthesia. Also, patients having their diagnostic spinal at night are more likely to have longer bed rest time according to their normal diurnal rhythm. This is not the case in parturients having caesarean section as their bed rest is mandated by the postoperative course regardless of the time of procedure. The

findings by Hayter et al. and Howard et al. [7,11] of the lack of effect of night work and sleep deprivation on overall performance of anesthetists is paralled in our study by the comparable numbers of attempts at spinal puncture between the two study groups and the single case of conversion to general anesthesia.

Although the average time of caesarean sections in the OCT group was in the early half of the night time, were sleep imterruption is not likely, the cocept of fatigue is still valid as our residents had been working since early morning. Emergency state is known to be associated with lesser time for preperation of patients and stress among personnel which may be reflected as a higher incidence of complications. The OCT group in our study had a higher percentage of emergency casarean sections. This is expected as no cases are electively scheduled on late shifts except when operative lists run late. However, when the incidence of PDPH was compared between elective and emergency procedures, it was found to be statistically comparable.

When all the above is considered together with the comparability of demographic, obstetric, and medical history related variables found in our study, it can be assumed that other factors may play a role in the development of PDPH. The stress of labor at night with its consequent lack of sleep in parturients themselves, and diurnal difference in the stress hormones levels may underlie a lower threshold to develop PDPH at night time! However, specially designed prospective studies will be needed to test the validity of such assumptions.

Compared to a national rate of about 28%, the rate of caesarian section in our hospital (45%) is high. The international average rate is about 18.7%, but still, there are some countries in other regions of the world which still have much higher rates like the Dominican Republic (56.4%) and Egypt (51.8%).[14] Our institutional high rate may be due to the fact that it is the only tertiary referral hospital in Northern Jordan with higher proportion of high risk pregnancies.

During the study period, the 25G Quincke spinal needle was the only needle used in spinal anesthesia for caesarean section. The incidence of PDPH in our study (26%) is comparable to its incidence in other studies which used the same needle type and size (about 25%).[15]

Our study was carried out on a homogenous group of participants in terms of gender, age group, position, and needle type and size. In addition, the operator level of experience and performance (i.e. no. of attempts) were also comparable between the two time groups. This provided a better focus on the study question of the effect of time of work on the incidence of PDPH despite our relatively small number of patients available during the study period.

In conclusion, our study has shown that caesarean section patients undergoing spinal anesthesia during the on-call work-time period are associated with a higher risk of developing PDPH than those undergoing spinal anesthesia during the day time work period. Specially designed studies with larger samples are encouraged to search for the underlying cause of this difference.

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تأثير فترات العمل المختلفة على نسبة الإصابة بصداع ما بعد بزل الجافية في حالات الولادة القيصرية تحت التخدير النصفي في مستشفى الملك المؤسس عبدالله الجامعي

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الملخص

الهدف: إن صداع ما بعد بزل الام الجافية هو نوع معروف الحدوث، ويعد من المضاعفات المعيقة بعد إجراء بزل الجافية. هناك الكثير من عوامل الخطورة التي تزيد من احتمالية حدوث هذه المضاعفة. أحد هذه العوامل هو العمل الليلي وما ينتج عنه من تقطع في النوم وإجهاد يؤديان لحوادث تخص سلامة العمل. إن تأثير العمل ليلا على احتمالية حصول هذا النوع من الصداع ما تزال في طور التأمل وليست قاطعة في أدلتها. هدف دراستنا هذه هو فحص وجود علاقة حقيقية بين العمل الليلي وحدوث صداع ما بعد بزل الجافية.

الطريقة: في هذه الدراسة الرقابية الاستشرافية، والتي عملت في مستشفى جامعي، قمنا بمقارنة نسبة الإصابة بصداع ما بعد بزل الجافية بين مجموعتين من السيدات الحوامل المدخلات من أجل الولادة، واللاتي ولدن عن طريق العملية القيصرية باستخدام التخدير النصفي (ليلا ونهارا). باستخدام شروط التشخيص القياسية، قمنا بمتابعة السيدات لمدة خمسة أيام بعد العملية القيصرية عن طريق الزيارات السريرية والمكالمات الهاتفية. كما قمنا أيضا بفحص تأثير وقت العمل على نسبة حصول صداع ما بعد بزل الجافية بمعاملة وقت العمل كأحد عوامل الخطورة المؤدية لمثل هذه المضاعفة وذلك باستخدام الوسائل الإحصائية المناسبة.

النتائج: كانت نتائج مقارنة المرضى متشابهة بين مجموعتي وقت العمل من النواحي الديموغرافية، والإجرائية وما يتعلق بالحمل ($P<0.05$). النسبة الكلية للإصابة بصداع ما بعد بزل الجافية كانت 26% (44/167). كان لوقت العمل الليلي قيمة أكبر معتبرة إحصائيا في نسبة الإصابة بصداع ما بعد بزل الجافية مقارنة بوقت النهار: 40% (17/42) ضد 21.6% (27/125) بالترتيب. كما بين فحص تحليل الانحدار وجود علاقة ارتباط قوية بين وقت العمل ونسبة حصول صداع ما بعد بزل الجافية (أكبر ليلا): (OR=2.58, CI 1.07-6.23, $P<0.05$).

الاستنتاج: بينت دراستنا وجود علاقة ارتباط قوية ما بين إجراء بزل الجافية ليلا في التخدير النصفي للعمليات القيصرية وارتفاع نسبة حصول صداع ما بعد بزل الجافية، وذلك مقارنة مع العمل النهاري. نشجع إجراء المزيد من الدراسات المصممة خصيصا لمعرفة الأسباب المؤدية لذلك.

الكلمات الدالة: الصداع، بزل الجافية، العملية القيصرية، الولادة، وقت العمل.