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Research Article

The effect of fluid therapy on spinal complications after surgery

Roj Muzafar[1*], Othman Ismat Abdulmajeed[2], Abdulhameed Abdulrazzaq Al-Dabbagh[3]

[1]SHO Anesthesia and Intensive Care, Erbil, Kurdistan Region-Iraq
[2]Head of Anesthesia and Pain Unit, Department of Surgery, College of Medicine, Hawler Medical University, Erbil, Kurdistan Region-Iraq.
[3] Consultant Anesthesiologist, Head of Department of anesthesia and Intensive Care Unit, Hawler Teaching Hospital, Erbil, Kurdistan Region-Iraq.

Abstract

Background and objective: Due to the risks and side effects of anesthesia drugs, concerns have increased in recent years and therefore studies have shifted to neuraxial anesthesia methods. The aim of this study was to evaluate the effect of fluid therapy on spinal complications after elective surgery.

Methods: This single-blind clinical trial study was performed on 120 patients undergoing elective surgery with spinal anesthesia. The samples were randomly divided into two groups of intervention (A) and control (B) (60 people in each group). Data were collected using visual analogue scale (VAS) at hours 4, 7, 24, 48, 72 and 7 days postoperatively via phone. SPSS software version 22 was used for analysis. The significance level of all statistical tests was considered 0.05.

Results: The mean headache up to 72 hours after surgery in the experimental group and in the intervention group up to 48 hours after surgery increased and then decreased. In the study of other spinal complications (low back pain) in participating patients, the average rate of low back pain increased to 72 hours after surgery in the experimental group and in the intervention group up to 48 hours after surgery and decreased after that.

Conclusion: PDPH. The results of our study generally showed that fluid therapy reduces the process of headache and low back pain in patients. However, due to the limited sample size and little information in this regard, more research is needed on the causes of complications of spinal anesthesia, such as the effect of anesthetics, dose, patient experience of pain, quality of postoperative education to prevent complications, and adherence to treatment by the patient are needed.

Keywords: Fluid therapy, Spinal anesthesia, Complications of spinal anesthesia, Surgery.

Background and objective

Different anesthesia methods can be used in different surgeries depending on the condition. Due to the risks and side effects of anesthetic drugs, concerns have increased in recent years, and for this reason, studies have shifted to neuraxial anesthesia methods. Neuraxial anesthesia is recommended to be used as an alternative to general anesthesia for lower extremity and subumbilical surgeries. According to studies and available statistics, general anesthetics have a higher risk of mortality than neuraxial methods[1,2].

Spinal anesthesia is a type of neuroaxial anesthesia that involves injecting an anesthetic into the subarachnoid membrane that is injected into the cerebrospinal fluid, causing numbness, pain, and obstruction.

*Corresponding Author: Roj Muzafar
Email: Rozhmuzafar@gmail.com

This is a type of safe anesthesia that is used as an alternative to general anesthesia by anesthesiologists and nurses in orthopedic surgery on the pelvis, thighs, knees, vascular surgery on the legs, hernia, cesarean section, etc[3].

Although this method is much less dangerous than other methods, it has side effects, too. The effects of this anesthesia are probably due to physiological effects on the nervous system. Most of the symptoms and complications are minor and can be easily removed. Cardiac arrest, severe hypotension, severe cardiovascular and neurological complications are acute, more serious and rare complications that occur and can lead to death.

Hypotension, nausea and vomiting, headache and nervous symptoms and pains are some of the common and minor complications that this method brings[3-6].

Fluid therapy or intravenous injection has been a common practice in medicine, which has received much attention in recent years. Intravenous fluid administration can be used as resuscitation, replacement, and maintenance. However, this prescription may also have side effects, symptoms, etc., which should be used with a proper approach and caution[7].

The complications of spinal anesthesia are very annoying for patients. This could be due to the release of CSF fluid. Liquid administration is a hypothesis that has emerged in recent years. Which is used to compensate for lost fluid and converted to CSF and the patient suffers less pain[8].

In cesarean section, which uses spinal anesthesia more because of its benefits, hypotension during anesthesia is an important complication that poses a great risk to the mother and even the fetus. Physicians use fluid therapy to prevent and maintenance, to minimize hypotension[9,10].

Headache, hypotension, etc., which are common complications after spinal anesthesia, cause many problems such as increased costs and many restrictions. The results of various studies have shown that intravenous fluid administration, which is a simple and profitable method, can greatly reduce complications[11].

The aim of this clinical trial study was to evaluate the effect of fluid therapy on spinal complications after elective surgery to obtain more evidence of this method and its benefits.

Methods

This single-blind clinical trial study was performed on 120 patients undergoing elective surgery with spinal anesthesia.

Inclusion criteria in this study were age over 18 years, ASA[1] 1 anesthesia, personal satisfaction, elective surgery, no history of cardiovascular disease, no history of migraine and seizures, no drug and alcohol addiction, no coagulation problems and no history of spinal surgery. Exclusion criteria included non-cooperation of the patient, failure to perform spinal, Dora puncture[1] more than 3 times, excessive bleeding during surgery, hypotension more than 20% of baseline that is not controlled by ephedrine and atropine and an incomplete spinal sensation that required anesthesia.

After obtaining patient satisfaction and recording demographic information in the questionnaire, the samples were randomly divided into two groups of intervention (A)

and control (B) (60 people in each group). Patients in the control group did not receive any serum before the operation and in the ward according to the hospital routine, but after entering the operating room, before spinal anesthesia, on average, they received only 100 cc of normal saline. Patients in the intervention group received 500 cc of normal saline half an hour before entering the operating room and after entering the operating room before spinal anesthesia, received 100 cc of normal saline similar to the control group. Patients were placed in supine position before spinal surgery and no pro-drug was injected into the group. At this time, after connecting the monitoring, non-invasive systolic and diastolic blood pressure[1], heart rate[2], arterial blood oxygen saturation[3], electrocardiography[4], which was the standard monitoring in this study, were measured and recorded as baseline values in the relevant checklist. Then the patients in both groups were placed in a sitting position and the spinal was performed by an anesthesiologist with bupivacaine 0.5% at the rate of 12 mg with Quincke needle number 27 in the vertebral space L4-L5 or L3-L4. After confirmation of the needle in the subarachnoid space, the contents of the syringe were slowly injected into the intrathecal space. To counteract the side effects of medications, a reduction of more than 20% in the initial amount of systolic blood pressure was considered hypotension requiring treatment and a reduction in heart rate of less than 45 beats per minute was considered bradycardia requiring treatment, which was treated with 10 mg intravenous ephedrine and 0.5 mg intravenous atropine, respectively. If nausea or vomiting was felt, this condition was treated with 4 mg of intravenous ondansetron. If a higher dose than expected or another drug is needed, the patient was excluded from the study. The amount of nausea and vomiting and medications received during the operation were recorded in the checklist. Patients in the postoperative period in terms of severity of headache and back pain with the visual analogue scale (VAS), which is scored from 0-10 with the level of: without pain (0), mild pain (1-3), pain Moderate (4-7) and severe pain (8-10) were at hours 4, 7, 24, 48, 72 and 7 days postoperatively via phone, and the questioner person did not know the type of intervention. The patient's chills and vital signs in the first 2 hours after surgery were also assessed by a researcher-made checklist.

The Shapiro-Wilk test was used to test the normality of quantitative variables. To compare the mean of the two independent groups, if the data of both groups were normal, t-test and otherwise Mann-Whitney U test were used. Job type, gender, the level of education of the intervention and test groups was determined using Fisher's exact test. ANOVA test with repeated measures was used to compare the mean headache and back pain between intervention and test groups during the treatment period. The significance level of all statistical tests was considered 0.05. The research steps are shown in Figure 1

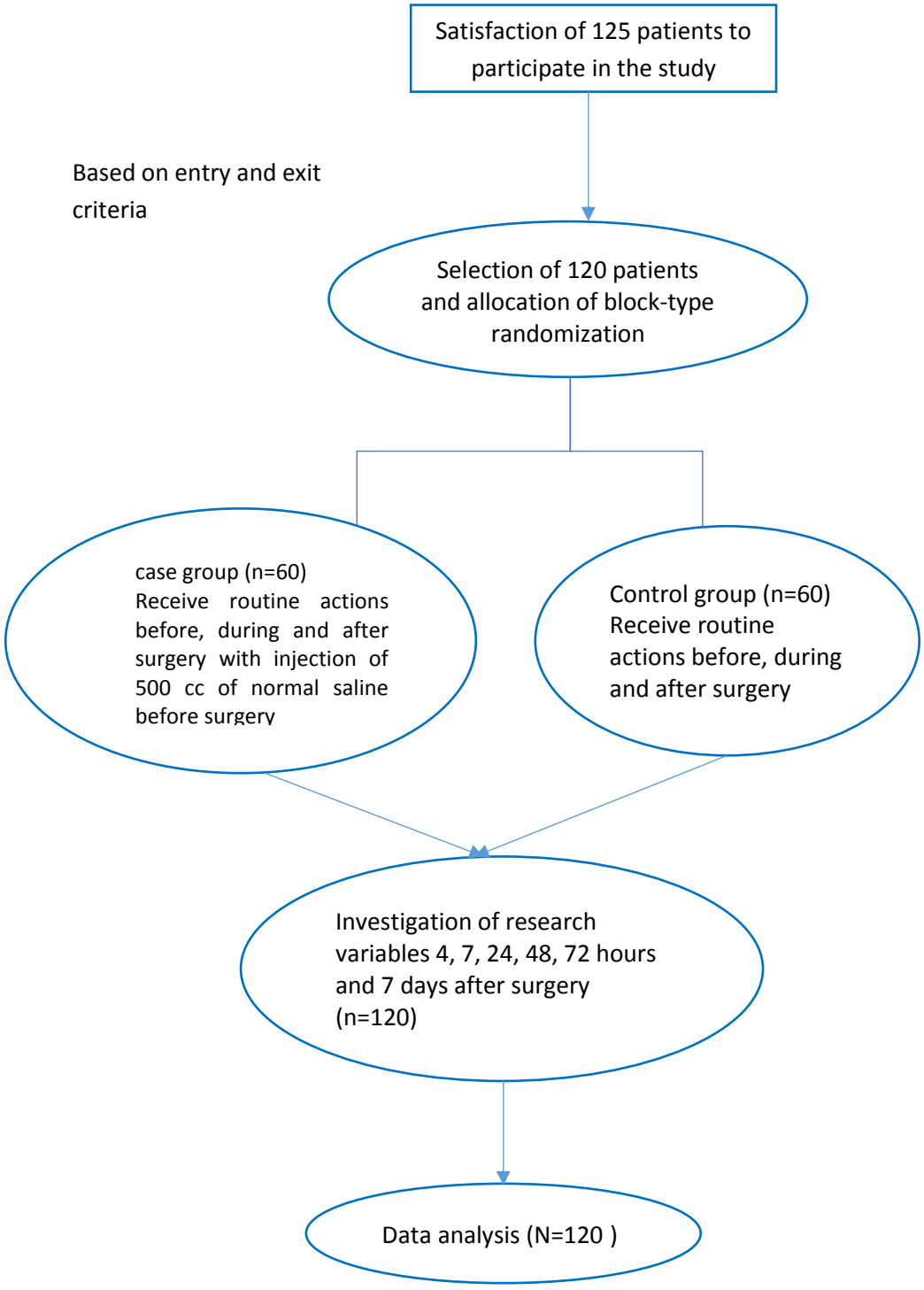

Figure 1. Clinical trial chart:

Results

In this study, 125 patients (60 in each intervention and control groups) were studied, which included: orthopedic surgery, cesarean section, hysterectomy and inguinal hernias. 5 people were excluded from the sample due to defects in completing the questionnaire. The mean age of patients in the intervention group was 29.83±6.654 and in the control group was 30.83±7.938 years old. The mean BMI in the intervention group was 29.093±4.861 and in the control group was 27.602±3.911. The information of other demographic variables is shown in Table 1. T-test for independent samples showed that there was no significant difference between age, BMI, length of operation and heart rate between the intervention and control groups (P> 0.05). Mann-Whitney U test also did not show a significant difference between systolic blood pressure and oxygen saturation in the two intervention and control groups (P> 0.05), but showed a significantly different level of diastolic blood pressure in the two groups (P <0.05). The difference between job type and education level of the two groups was not statistically significant using Fisher's exact test (P> 0.05). On the other hand, with repeated measurements and accurate Fisher's test, ANOVA showed that the amount of headache depends on occupation and gender (P <0.05) so that students and staff in the first 4 and 7 hours after the operation and men had more pain than women. Spearman correlation test also showed that the headache rate was independent of variables such as age, BMI, length of operation, heart rate, blood pressure, oxygen saturation percentage and the number of try ruptures (P> 0.05). (1 and 2).

Spearman correlation test showed that the amount of headache and low back pain were independent of variables such as age and BMI, length of operation, heart rate and percentage of oxygen saturation and number of anesthesia (number of attempts for anesthesia).

Figure 4 shows the average headache during 4, 7, 24, 48, 72 hours and 7 days after surgery in the intervention (A) and control (B) groups. As can be seen in the graph, the mean headache increased up to 72 hours after surgery in the control group and decreased up to 48 hours after surgery in the intervention group, but according to Greenhouse-Geisser statistics in ANOVA test with repeated measures, there was no significant difference in the rate of headache at different times (p> 0.05). While the mean headache in the intervention group in the first 48 hours was higher and then less than the control group but ANOVA with repeated measurements did not show a significant difference (p> 0.05). Fisher's exact test also confirmed the ANOVA test results and showed that there is no relationship between headache rate and preoperative serum therapy (p> 0.05). Student test did not show a significant difference between the headache rates of the two groups in any of the measured times (p> 0.05). The mean headache of those for whom the number of tries is 2 and 3 is less than the average of the headache for those for whom the number of tries is 1, but ANOVA showed with repeated measurements that this difference is not significant (P > 0.05).

In the study of other spinal complications (low back pain) in participating patients, as shown in Figure 3, the average rate of low back pain increased to 72 hours after surgery in the control group and to 48 hours after surgery in the intervention group and decreased after that Greenhouse-Geisser statistics in ANOVA test with repeated measures also showed a significant difference in low back pain at different times ($p < 0.05$). ANOVA with repeated measures also showed that the rate of low back pain after surgery in The control group was always lower than the group that received serum before surgery ($p < 0.05$). Fisher's exact test did not find a significant relationship between nausea, vomiting and chills with preoperative serum therapy and type of surgery ($p > 0.05$).

Discussion

PDPH is the most important delayed complication of spinal anesthesia[12]. Existing treatments are not the definitive treatment for this complication, so it seems necessary to study new treatment methods and ways to prevent headaches. The aim of this study was to determine the effect of preoperative serum therapy on the prevention of complications after spinal anesthesia in surgery. Findings of the study did not show a statistically significant relationship in the rate and severity of postoperative headache in the intervention and control groups. However, the time to start reducing pain was shorter in the intervention group than in the control group (48 hours postoperatively in the intervention group and 72 hours postoperatively in the control group) and in the intervention group after 48 hours the trend of headache was decreasing which it was less than the control group, but this difference was not significant. Also, fluctuations in headache rate in the experimental group were more than the intervention group. In the intervention group, the rate of headache did not increase up to 7 hours after the operation and was constant, while in the control group, the trend increased up to 7 hours after the operation and was higher than the intervention group. This stability in the intervention group can indicate the compensation of intravascular volume (due to serum therapy) up to 7 hours after surgery, because if the patient suffers from a lack of volume, the cerebral arteries dilate to compensate for this reduction in volume, which in turn causes headaches[4-6].

In general, at hour 7, 72 and day 7, the rate of headache in the intervention group was less than the control, but this difference was not significant which is consistent with the findings of the study of Dieterich et al[13], and Eldevik et al[14]. Despite the lack of evidence, Vanzetta et al. suggested the effect of fluid therapy for patients after anesthesia and stated that 90% of centers use this method to prevent headaches after anesthesia[15]. There was no relationship between the type and volume of intravenous fluid therapy during and after surgery between the two groups. Some researchers believe based on their observations that the patient's hydration can affect the incidence of PDPH[16,17]. In other words, while volume preload reduces the incidence and degree of sympathetic obstruction due to spinal anesthesia, it does not appear to affect the prevalence of headache[18]. In short, the patient's natural

hydration must be maintained. Excessive hydration does not reduce headaches, but dehydration can make symptoms worse. Gosch et al consider some methods to preventive headache after spinal anesthesia such as reduce the patient's fear, sufficient fluids, use of smaller needles and the use of special needles[19]; But the evidence for this is not yet clear[20]. The mean rate of low back pain in this study increased up to 72 hours after surgery in the control group and in the intervention group up to 48 hours after surgery and decreased afterwards, so that fluid therapy reduced the duration of low back pain in patients, which was consistent with the Haghighi study[21]. In further study, the author did not find related research to confirm or deny the data. Considering that no research has been done in this field so far, it may be necessary to further investigate by increasing the number of participating samples and its amount and severity after one week and taking into account the culture and customs of the region so that more accurate and more generalizable information can be obtained. However, this research is significant because of its new and innovative inference.

In this study, also the types of variables based on surgery such as duration of surgery, history of headache or back pain, history of spinal anesthesia, hemodynamic symptoms of patients before, during and after surgery, the amount of needle insertion into the dorsum and other complications spinal sensations such as low back pain, chills, and nausea and vomiting were compared with time factors. It should be noted that needle size, injection angle, and injector were considered constant.

The results showed that the rate of headache was independent of variables such as age, BMI, length of operation, heart rate, blood pressure, oxygen saturation and try number (P> 0.05). There was no significant relationship between sex, age, needle number and headache in the study[15,21,22]. In Rahimi study[23] and Kempen study[24], no significant relationship was observed between headache and hemodynamic oscillations of the patient as in our study.

In Nazemi's study[25], a significant relationship was observed between BMI and headache, which was contrary to our findings; on the other hand, the ANOVA, with repeated measurements, showed that the mean headache of those for whom the number of try times was 2 and 3 is less than the pain in those whom the number of tries was 1, but this difference is not significant.

Also, with repeated measurements and Fisher’s exact test, ANOVA showed that the amount of headache depends on the job (P <0.05), so that students and employees had more pain in the first 4 and 7 hours after the operation than others, which is consistent with the study of Wu[23,26] and Haghighi[21]. Some studies have shown an inverse relationship between PDPH and aging. Patients between the ages of 20 and 40 are more sensitive, with the lowest incidence occurring after the fifth decade[27,28].

In summary, many studies determine the factors affecting the prevalence of PDPH: age, sex, pregnancy, previous history of post-spinal headache, needle size, needle tip shape, needle orientation to Dora fibers, number of needle insertions into Dora, Median technique (midline) versus paramedian technique (lateral), the type of

local anesthetic solution and clinical experience of the anesthesiologist[29]. In our study, these factors were controlled and only the effect of fluid therapy on the rate of headache was investigated. However, there is still insufficient information about the effect of these factors; Therefore, more research is needed. The good thing about our article is that we have been able to control most of these factors and only examine spinal interventions and complications.

Conclusion

PDPH can increase the workload of physicians. This complication can increase patients' hospital stay and treatment costs. There are significant variables in the incidence of PDPH, including age, sex, number of attempts, type of needle (design) and size, history of previous PDPH or chronic headache, anesthesiologist experience that in our study these factors were controlled and the only effect of Fluid therapy was evaluated. The results of our study generally showed that fluid therapy reduces the process of headache and low back pain in patients. However, due to the limited sample size and little information in this regard, more research is needed on the causes of complications of spinal anesthesia, such as the effect of anesthetics, dose, patient experience of pain, quality of postoperative education to prevent complications and adherence to treatment by the patient. The limitations of this study are: the small number of samples, lack of measurement of headache and low back pain in the two groups before the intervention, headache and low back pain after one month, lack of control of underlying variables such as patient mobility (days of absolute rest), the type of lifestyle and nutrition.

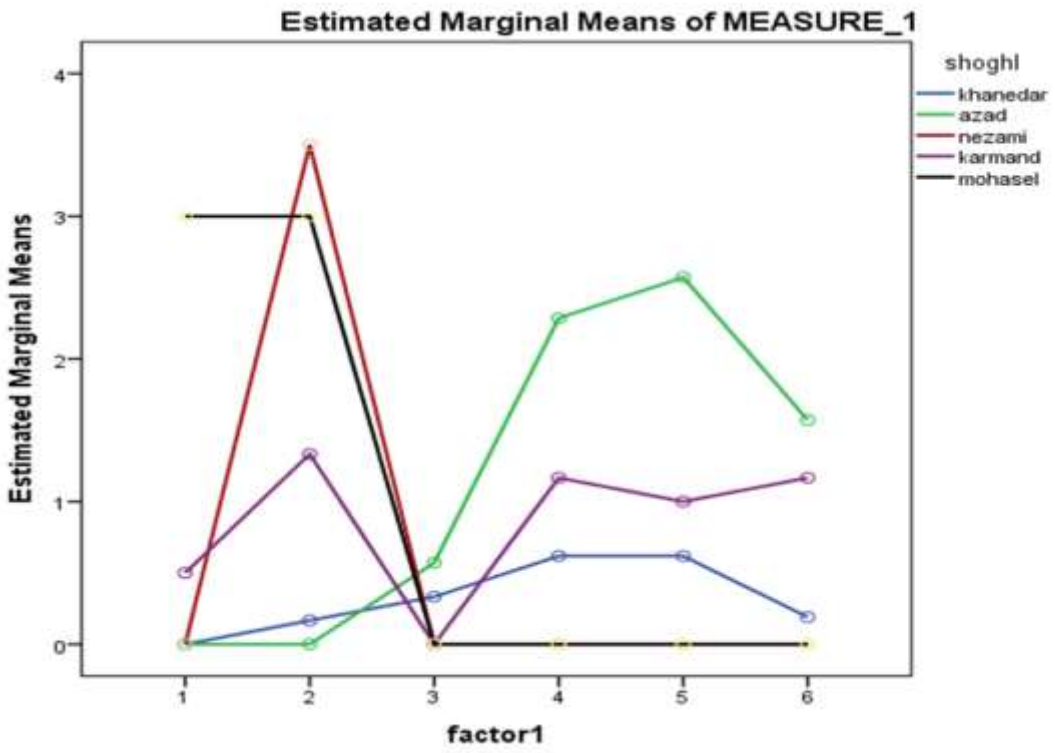

Figure 2: Average pain intensity based on job after surgery

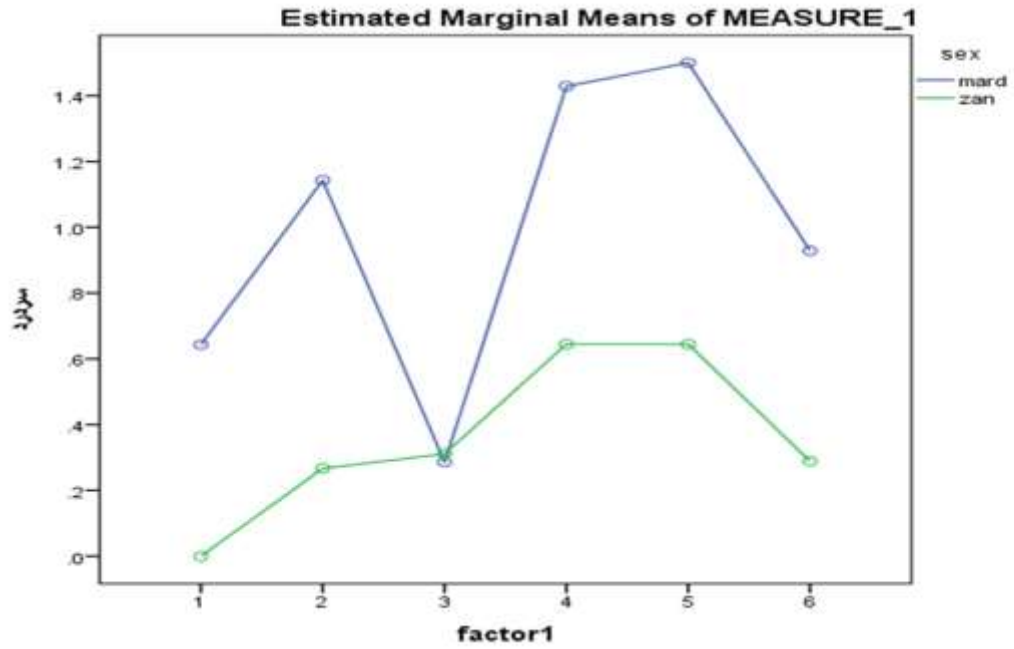

Figure 3: The rate of pain change by gender

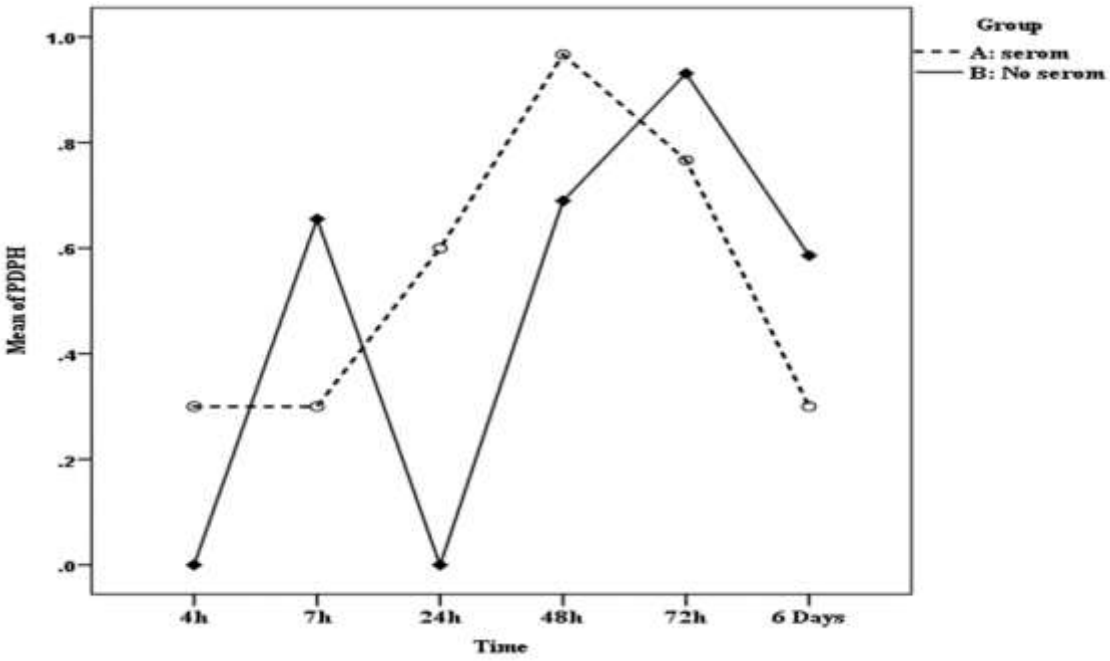

Figure 4: Average severity of headache at different times

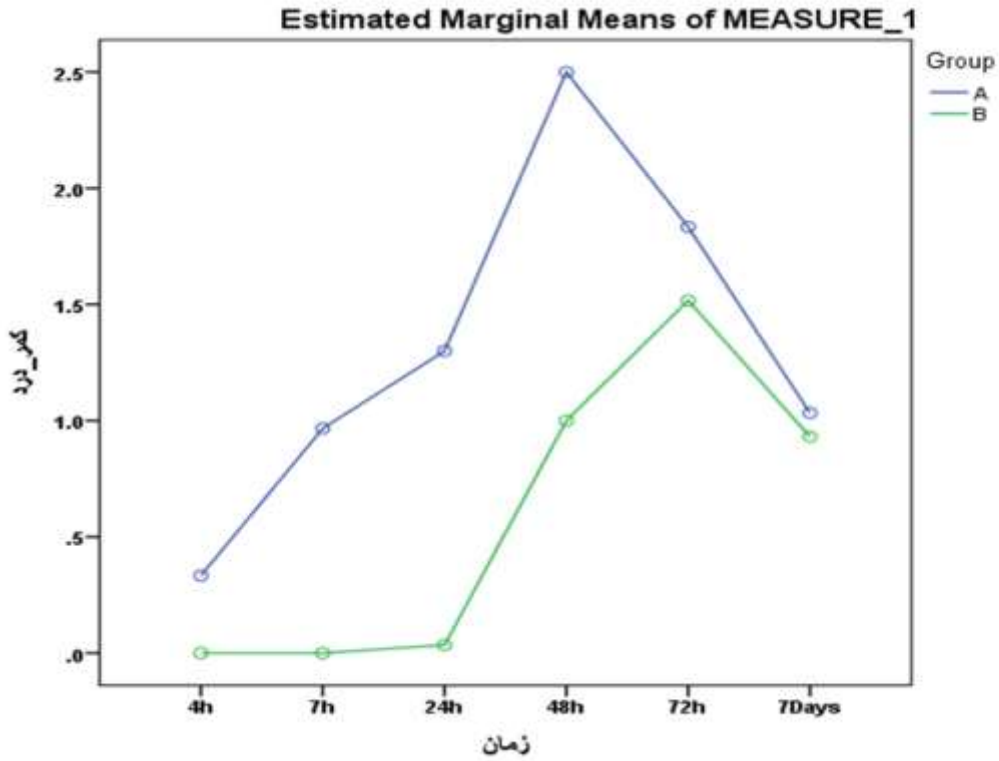

Figure 5: Average severity of low back pain at different times

Table 1. Report

group		age	bmi	Tool_amal	sbp	dbp
a--serom	Mean	29.83	29.0930	42.1667	122.60	78.27
	N	60	60	60	60	60
	Std. Deviation	6.654	4.86167	21.11885	26.055	18.791
	Std. Error of Mean	1.215	.88762	3.85576	4.757	3.431
b--No-serom	Mean	30.83	27.6024	33.6207	124.14	73.24
	N	60	60	60	60	60
	Std. Deviation	7.938	3.91130	11.01108	15.704	11.652
	Std. Error of Mean	1.474	.72631	2.04471	2.916	2.164
Total	Mean	30.32	28.3603	37.9661	123.36	75.80
	N	120	120	120	120	120
	Std. Deviation	7.267	4.44614	17.32346	21.427	15.764
	Std. Error of Mean	.946	.57884	2.25532	2.789	2.052

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