ORIGINAL ARTICLE

A Study on the Effect of Education by Using Simulation on Post partum Visual Blood Loss Estimation

Background: Post partum hemorrhage is one of the common causes in maternal morbidity and mortality and its outcome depends on accurate estimation of blood loss which needs acquiring skills. In this study, we decided to evaluate the effect of education on visual blood volume estimation by using simulation.

Method: This prospective study was done in Mashhad University of Medical Sciences and 40 obstetrics and gynecology residents who had inclusion criteria and signed consent forms participated in it. The study was designed to include three stages; namely, pre-test, education-based simulation, and post-test. At first, six stations were simulated, along with, Post partum hemorrhage in different volumes (500, 1000, 1500, 2000, 2500 and 3000 cc). Then, participants were requested to fill their personal details in forms and view different simulated stations and estimate correct blood volume as pre-test. In the following stage, the researcher educated participants about correct volume in each station. In the final stage, six stations with the same volumes were simulated and the post-test was performed like the pretest. After data collection, it was statistically analyzed by SPSS software (version 11.5) and Chi-Square and McNemar Tests. P value less than 0.05 was considered significant.

Findings: Participants were 40 people of obstetrics and gynecology residents. The comparison between the results of pre- and post-tests, illustrated that the accuracy visual estimation in different blood volumes (500, 1000,1500,2000,2500, and 3000cc) had significantly differed (P= 0.008, P<0.001, P<0.001, P=0.001, P<0.021, P=0.001, respectively).

Conclusion: Education via simulation had a significant effect on the accuracy of visual estimation of blood volume.

Keywords: Education, simulation, Post partum hemorrhage, Visual estimation

Farideh Akhlaghi [1,*], Vida Taghipour Bazargani[2]

[1] Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, IRAN.

[2] Mashhad university of Medical Sciences, Mashhad, IRAN

[*] Omalbanin Hospital, Behjat street, Mashhad, IRAN

postal code: 9144663595
Tel. & fax: 0098 511 2231444
Email: akhlaghif@mums.ac.ir

دراسه اثر التعليم عبرالمولاج تجاه تقييم مستوى النزيف بعد الولاده بشكل نظرى

المقدمه: إن النزيف بعد الولاده من العلل الشائعه لموت الام و إن هذا الامر يرتبط به التخمين الصحيح لكميه النزيف و هذا الامر يحتاج الى مهاره عاليه. هدفت هذه الدراسه الى مطالعه مستوى التأثر للتعليم عبرالمولاج على تخمين مستوى النزيف بشكل نظرى.

إسلوب العمل: فى هذه الدراسه المستقبليه التى اجريت فى جامعه مشهد الطبيه تم ادخال ٤٠ طالبه طب نسايى و ولاده بعد ان اخذت الموافقه منهم بشكل كتبى لقد اجريت الدراسه على ثلاث مراحل ١- الاختبار المسبق ٢- التعليم عبرالمولاج و ٣- الأختبار التالى.

فى البدايه تم تعيين ستة مواقف تشبه النزيف بعد الولاده باحجام دم مختلفه (٥٠٠،١٠٠٠،١٥٠٠،٢٠٠٠،٢٥٠٠،٣٠٠٠) و بعد ذلك طلب من المشتركون إن يشاركو فى مرحله الاختبار المسبق و يدخلوا الى المحطات و يسجلو ما يرونه و فى المرحله الثانيه المحقق يعطى المعلومات الصحيحه بشكل تعليمى و بعد ذلك يأتى الاختبار التالى و هو فى المرحله الثالثه بأن يتم اختبار المشتركون عبرالمواقف بنفس حجم الدم المسبق . تم تجميع و تحليل المعطيات عبر برنامج SPSS النسخه ١١.٥ و الاختبارات الأحصائيه كاى سكوئر و مك نمار و عين P=0.05

النتائج: كان المشتركون ٤٠ طالبه من قسم النسائى و الولاده و كان هناك اختلاف واضح فى تخمين نسب (٥٠٠،١٠٠٠،١٥٠٠،٢٠٠٠،٢٥٠٠،٣٠٠٠cc) على الترتيب تالى P=0.001, P<0.021, p=0.001, P<0.001, p<0.001 . p=0.008

النتيجه: إن التعليم عبرالمولاج له تأثير بارز فى صحه التشخيص

الكلمات الرئيسيه: التعليم، المولاج، النزيف بعد الولاده، التخمين عبرالرؤيه

زچگي کے بعد خونریزی کا اندازہ لگانے کی ٹریننگ

بیک گراونڈ: زچگي کے بعد خونریزی زچہ کی موت کا بنیادی سبب ہے اور ماں کو بچانے کے لئےضروری ہے کہ خونریزی کی مقدار کا صحیح اندازہ لگایا جائے، خونریزی کی مقدار کا صحیح اندازہ لگانے کے لئے مہارت درکار ہوتی ہے، اس تحقیق کا مقصد بلڈ ماڈلز کے ذریعے خونریزی کی مقدار کاصحیح اندازہ لگانا سکھانا ہے۔

روش: اس تحقیق میں جو مشہد یونیورسٹی آف میڈیکل سائنسس میں انجام دی گئي تھی گائي ناکولوجی اور مڈوائفری کی چالیس طالبات کو شامل کیا گیا۔ ان طالبات کو ان کی مرضی سے فارم پر کرنے کے بعد شامل کیا گیا۔ تحقیق تین مرحلوں میں انجام دی گئي ، پری ٹسٹ، ٹریننگ اور پوسٹ ٹسٹ ۔ پہلے چھے اسٹیشن بنائے گئے جن میں زچگی کے بعد خونریزی کے بلڈ ماڈل رکھے گئے، ان بلڈ ماڈلز میں خون کی مقدار پانچ سو، ایک ہزار، ڈیڑھ ہزار، دوہزار، ڈھائي ہزار اور تین ہزار سی سی تھی ۔ ا سکے بعد تحقیق میں شریک ایک ایک طالبہ سے کہا گیا کہ وہ ہر اسٹیشن پرجائے اور پری ٹسٹ مرحلے میں ہراسٹیشن پر خون کی مقدار کا اندازہ لگائے اور فارم میں لکھ دے، اس کےبعد کے مرحلے میں استاد نے تحقیق میں شریک طالبات کو خون کی صحیح مقدار کے بارے میں معلومات فراہم کیں ۔ تیسرے مرحلے میں دوبارہ چھے اسٹیشنوں پر خون کی مقدار کے بارے میں سوالات ہوئے۔ حاصل شدہ ڈاٹا کا ایس پی ایس ایس سافٹ ویر اور کائے اسکوائر اور مک نمار سے تجزیہ کیا گیا۔

نتیجے: تحقیق میں چالیس ریذیڈنٹ طالبات نے شرکت کی پری ٹسٹ اور پوسٹ ٹسٹ کے جوابوں سے معلوم ہوتا ہے کہ طالبات کے جوابوں اور صحیح جوابوں میں کافی فرق پایاجاتا ہے ۔

سفارش: بلڈ ماڈل سے خونریزی کی مقدار کاصحیح اندازہ لگانے کی تعلیم نہایت مفید واقع ہوسکتی ہے۔

کلیدی الفاظ: خونریزی، بلڈ ماڈل ، زچگي ۔

بررسی اثر آموزش بر اساس شبیه سازی روی تخمین دیداری حجم خونریزی بعد زایمان

زمینه و هدف: خونریزی بعد از زایمان یکی از علل شایع مرگ و میر مادری است و سرنوشت آن وابسته به تخمین صحیح خونریزی می باشد. تخمین صحیح خونریزی نیاز به کسب مهارت دارد.در این بررسی ما تصمیم گرفتیم تا اثر آموزش با استفاده از شبیه سازی را بر تخمین دیداری حجم خون مورد مطالعه قرار دهیم.

روش: در این مطالعه آینده نگر که در دانشگاه علوم پزشکی مشهد انجام شد ۴۰ نفر از رزیدنت های زنان و مامایی که دارای شرایط ورود بوده و فرم رضایت شرکت را امضا نمودند ، وارد مطالعه شدند. مطالعه در سه مرحله پره تست، آموزش بر اساس شبیه سازی و پست تست طراحی شد. ابتدا شش ایستگاه همانند خونریزی بعد از زایمان در حجم های مختلف خون (۵۰۰،۱۰۰۰، ۱۵۰۰، ۲۰۰۰، ۲۵۰۰ ، ۳۰۰۰ سی سی) شبیه سازی شد. سپس از شرکت کنندگان درخواست شد مشخصات خود را در پرسشنامه تکمیل نمایند و درمرحله پره تست به ایستگاه های مختلف وارد شده و حجم خون هر ایستگاه را دید تخمین بزنند و در فرم بنویسند. در مرحله بعد محقق در هر ایستگاه به شرکت کنندگان حجم صحیح خون را آموزش داد. در مرحله پست تست دوباره شش ایستگاه با همان حجم های خون شبیه سازی و پره تست انجام شد. اطلاعات به دست آمده جمع آوری و آنالیز آماری با استفاده از نرم افزار آماری SPSS نسخه ۱۱/۵ و تست های آماری کای اسکوئر و مک نمار انجام شد. سطح معنی داری P ۰/۰۵ در نظر گرفته شد.

یافته ها: شرکت کنندگان ۴۰ نفر از رزیدنت های زنان و مامایی بودند. مقایسه بین پره تست و پست تست نشان داد که صحت تخمین حجم خون در حجم های مختلف (۵۰۰، ۱۰۰۰، ۱۵۰۰، ۲۰۰۰، ۲۵۰۰، ۳۰۰۰ سی سی) تفاوت معنی داری دارد (به ترتیب P = ۰/۰۰۸ ، P < ۰/۰۰۱ ، P < ۰/۰۰۱ ، P = ۰/۰۰۱ ، P < ۰/ ۰۲۱ ، P < ۰/۰۰۱=P).

نتیجه گیری: آموزش بر اساس شبیه سازی اثر معنی داری بر صحت تشخیص دیاری حجم خون دارد.

کلمات کلیدی: آموزش، شبیه سازی، خونریزی بعد از زایمان، تخمین دیداری

INTRODUCTION

Post partum hemorrhage (PPH) is the most common cause of maternal mortality worldwide (1), and is an important cause of morbidity in the developing and developed countries, occurring in up to 18% of births (2). Its recognition depends on an assessment or estimation of blood loss. However, despite the long-held and widely-accepted definition, assessing post partum blood loss accurately remains a problem. Estimates of post partum blood loss calculated by health care providers using subjective visual quantification are, in clinical settings, known to be filled with error (3-5). Therefore, one of the major problems in international literature is how to measure post partum blood loss accurately (6). In clinical practice, the amount of blood lost during childbirth is typically visually estimated by the birth attendant; underestimation is common but in some cases overestimation occurs (7). It is vital to estimate blood loss volume during child birth and post partum, because the fourth stage of post partum is critical for diagnosis and treatment; delay in the diagnosis and treatment of maternal hemorrhage may lead to significant maternal morbidity, which includes shock and disseminated intravascular coagulation, or to maternal death (8). Several studies have shown that blood loss is overestimated at low volumes (<150 mL) and underestimated at high volumes, and that as blood volumes increase, estimation error also increases (9-12). Studies indicate an underestimation of 25% to 50% when visual assessment is compared to a more objective measurement, such as the "gold standard" of photo spectrometry (10). One of the important factors to inaccurate estimation of blood loss is lack of accurate and integrated method for estimation. Simulations have been used by the military, airline industry, and our colleagues in other medical specialties to educate, evaluate, and prepare for rare but life-threatening scenarios (13). In medical specialties, such as anesthesia, the use of simulation has increased over the past 15 years. Medical simulation attempts to reproduce important clinical situations to practice team training or individual skills in a risk-free environment (14). Work hour limits for residents in obstetrics and gynecology and decreased patient availability for teaching residents forced us to think creatively and practically on how to optimize their education. Medical simulations may address scenarios in clinical practice that are considered important to know or understand (13). To our knowledge, there has not been any other research in Iran about using simulation for education accuracy of blood loss. On the other hand there is limited information with regard to the use of simulation as an educational tool for blood-loss estimation (11, 15). The aim of this study was to evaluate the effect of education by using simulated scenarios on the accuracy of blood loss volume estimation for the first time between obstetrics and gynecology residents of Mashhad University of Medical Sciences in Mashhad, Iran.

METHODS

This prospective study was approved by Ethics Committee of vice research of Mashhad University of Medical Sciences in Iran and was done in three stages; namely, pre-test, education-based simulation and post-test.

The sample size was equal to that of the population of obstetrics and gynecology residents. The inclusion criteria were academic study in obstetrics &Gynecology science that tend to participate in the study. Exclusion criteria included a resident who was unable or unwilling to participate, for any reason. Of all 44 obstetrics and gynecology residents, four of them were unable to participate in study. Finally, 40 residents participated, including 14 freshmen, 12 second-year, 10 third-year and 4 fourth-year obstetrics and gynecology residents.

First, the aim and importance of the study was explained to them and the participants signed consent forms and allowed their results to be used for the present study. The study was designed to include three stages; i.e. pretest, education-based simulation, and post-test. Then, expired packs of red blood cells were collected in refrigerator up to the amount necessary to achieve the desired volume for simulation in each and every study stations. Study stations would include beds covered with large pads, which simulated the postpartum hemorrhage in different volumes, including 500 cc, 1000 cc, 1500 cc, 2000 cc, 2500 cc, and 3000 cc. Next, all participants filled their personal details in the forms and observed sequentially different stations with a simulated specified amount of bleeding and evaluated correct blood volumes and wrote them in the pre-test sheet. Then all pre-test sheets were collected and the researcher informed them, all, of the correct volume in each station. In the final session, the six stations were simulated with the same amount of blood as the pretest volume. Post-test was performed like the pre-test by viewing the simulated stations and estimating correct volumes and writing them in their post-test sheet.

The data of the pre-test and post-test was collected and was statistically analyzed by SPSS software (version 11.5). The accuracy of estimated blood volume in each of the simulated stations was determined before and after education. The accuracy of estimated blood volume in each simulated station, before and after the education process, was compared. The relation between the accuracy of estimated blood volume and the academic year of obstetrics & gynecology residents was determined and compared before and after education by using Chi-Square and McNemar Tests. The probability value, less than 0.05, was considered significant.

RESULTS

In this prospective study, 40 obstetrics and gynecology residents of Mashhad University of Medical Sciences in Iran participated. Comparison of estimation blood volumes among participants based on the academic year before education had significantly differed for two volumes 1000 and 2000cc ($P=0.004$, $P=0.03$), but after education, they were remarkably different in the estimation blood volume, 3000 cc ($P=0.004$) (Table 1). Result of the pre-test for all residents expressed that estimation in blood volume (500 cc) was accurate in 75%, and just incorrect in 25%. However, after education, 97.5% showed correct estimation and just one person had incorrect estimation in the post-test. Comparison of the accuracy of blood volume

estimation between pre- and post-test was significant (P= 0.008). Pre-test estimation of blood volume (1000 cc) was 50% correct and 50% incorrect whereas post-test estimation depicted that 95% of residents had correct estimation,; thus, the difference between pre- and post-test was significant (P<0.001). For blood volume (1500 cc), before education estimation in 55% was incorrect and after education, only 5.1% was incorrect; and the difference between pre-and post-test was significant (<0.001). Result of pre-education test in blood volume (2000 cc) indicated that 30 resident (75%) had incorrect estimation and just 10 person had correct estimation of volume, but after education 27 resident had correct estimation ; thus, the difference between pre- and post-education test was significant (P=0.001). For blood volume (2500 cc), pre-education test was incorrect in 75%; nevertheless, after education test estimation resulted in 50% correct and 50% incorrect; thus, the difference was significant (P<0.021). Finally, for blood volume (3000 cc), pre-test estimation was incorrect in 75% while after education, the test estimation was correct in 60% with a significant difference (P=0.001) (Table 2).

On the other hand, comparison of blood volume estimation before and after education, based on academic year residency, was carried out. Result of pre-test estimation of blood volume (500cc) showed that 71.4% of freshmen, 75% of second-year and 80% of third-year residents had correct estimation. Interestingly, after education all first-year and third-year residents had correct estimation and just one of the second-year residents had incorrect estimation. All fourth-year residents had correct estimation in pre- and post-education test for blood volume (500cc). As to blood volume (1000 cc), pre-test estimation stressed that 71.4% of first-year, 8.3% of second-year, 60% of third-year and 50% of fourth-year residents had correct estimation. On the other hand, after education test indicated that 100% of first, third and fourth-year residents, as well as, 83.3% of second-year resident had correct estimation. For blood volume (1500 cc), correct estimation before education were 64.3% of first-year, 25% of second-year, 40% of third-year and 50% of fourth-year residents and after education all of first, third and fourth-year residents along with 81.1% of second-year residents had correct estimation. As to blood volume (2000 cc), before education all second-year residents had incorrect estimation, and after education just all of fourth-year residents had correct estimation. First, second and third-year residents increased their correct estimation after education. Regarding blood volume (2500 cc), the minimum correct estimation belonged to second-year residents and the maximum to fourth-year residents, before education. However, after education, correct estimation increased among first, second and third-year residents; in addition, all fourth-year residents had correct estimation. Finally, for blood volume (3000 cc), the minimum estimation belonged to second-year residents, and the

Table 1: Comparison of blood volume estimation before and after education by using simulation on different blood volume based on academic years of obstetrics and gynecology residents

		Before Education					After Education				
		Group Residents					Group Residents				
		first year	second year	third year	fourth year	P value	first year	second year	third year	forth year	P value
Blood volume	**Estimation**	**N (%)**	**N (%)**	**N (%)**	**N (%)**		**N (%)**	**N (%)**	**N (%)**	**N (%)**	
500 cc	Incorrect	4 (28.6)	3 (25)	2 (20)	0 (0)	.765	0 (0)	1 (8.3)	0 (0)	0 (0)	.650
	Correct	10 (71.4)	9 (75)	8 (80)	4 (100)		14 (100)	11 (91.7)	10 (100)	4 (100)	
1000 cc	Incorrect	4 (28.6)	11 (91.7)	4 (40)	1 (25)	.004	0 (0)	2 (16.7)	0 (0)	0 (0)	.263
	Correct	10 (71.4)	1 (8.3)	6 (60)	3 (75)		14 (100)	10 (83.3)	10 (100)	4 (100)	
1500cc	Incorrect	5 (35.7)	9 (75)	6 (60)	2 (50)	.264	0 (0)	2 (18.2)	0 (0)	0 (0)	.143
	Correct	9 (64.3)	3 (25)	4 (40)	2 (50)		14 (100)	9 (81.8)	10 (100)	4 (100)	
2000cc	Incorrect	7 (50)	12 (100)	8 (80)	3 (75)	.030	4 (28.6)	4 (33.3)	5 (50)	0 (0)	.380
	Correct	7 (50)	0 (0)	2 (20)	1 (25)		10 (71.4)	8 (66.7)	5 (50)	4 (100)	
2500cc	Incorrect	10 (71.4)	10 (83.3)	8 (80)	2 (50)	.675	7 (50)	9 (75)	4 (40)	0 (0)	.063
	Correct	4 (28.6)	2 (16.7)	2 (20)	2 (50)		7 (50)	3 (25)	6 (60)	4 (100)	
3000cc	Incorrect	9 (64.3)	11 (91.7)	7 (70)	3 (75)	.465	6 (42.9)	9 (75)	1 (10)	0 (0)	.004
	Correct	5 (35.7)	1 (8.3)	3 (30)	1 (25)		8 (57.1)	3 (25)	9 (90)	4 (100)	

Table 2: Comparison of blood volume estimation before and after education by using simulation on different blood volume between obstetrics and gynecology residents

Blood volume	500		1000		1500		2000		2500		3000	
	Test		Test		Test		Test		Test		Test	
Estimated Volume of blood	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
	N (%)	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**
Incorrect	9 (22.5)	1 (2.5)	20 (50)	2 (5)	22 (55)	2 (5.1)	30 (75)	13 (32.5)	30 (75)	20 (50)	30 (75)	16 (40)
correct	31 (77.5)	39 (97.5)	20 (50)	38 (95)	18 (45)	37 (94.9)	10 (25)	27 (67.5)	10 (25)	20 (50)	10 (25)	24 (60)
Missing	0	0	0	0	0	1 (2.5)	0	0	0	0	0	0
P value*	0.008		< 0.001		< 0.001		0.001		<0.021		0.001	

*McNemar test

maximum to first-year ones, before education; after education, though, 90% of third-year and all fourth-year residents had correct estimation; besides, the first and second-year residents increased their correct estimation (Table 2).

In this study, the researchers simulated 6 scenarios with specific measured amount of blood by using expired packed red cells from blood bank. First, obstetrics and gynecology residents participated in pre-test for visual estimation in each simulated scenarios; then they were educated about the correct volumes. In the end, post-test was done and each of the participants estimated blood volumes in different simulated scenarios. The data of pre-and post-test estimation were statistically analyzed. Results indicated that blood volume estimation after education through using simulation on different blood volumes increased accurate estimation of obstetrics and gynecology residents. Although wrong estimation before training was low in volumes up to (1500 cc), after education almost all trainees had correct estimation. Conversely, in volumes (2000 cc) and more correct estimation in pre-test was low and education improved their correct estimation. On the other hand, estimation based on different academic years showed a difference among them regarding estimation; for all of the trainees, accurate estimation in blood volume up to (1500 cc) was greater than blood volume (2000 cc) and more, both in pre- and post-tests. Since the post partum hemorrhage is one of the leading causes of maternal death accounting for 11% of maternal deaths worldwide; in addition, delay in the diagnosis and treatment of maternal hemorrhage may lead to significant maternal morbidity, which include shock and disseminated intravascular coagulation, or maternal death (16). One of the contributing factors to maternal death from post partum hemorrhage is incorrect blood loss estimation and lack of a formal method for educating obstetrics and gynecology residents, i.e. how to correctly estimate blood loss. Using innovation in teaching and preparing new educational methods plays an important role in medical sciences education (17). Also, many medical universities around the world have gone through stunning changes in recent years; some of these changes have been made with the support of international organizations. They changed traditional training programs based on teacher- centered learning and disciplined approach to the educational course based on community needs responsivity and Student-centered learning (18). Therefore, many researchers have been trying to find a way to prevent maternal deaths due to hemorrhage, which were potentially preventable (8, 9). Toledo and colleagues evaluated the impact of a didactic training program on the accuracy of the estimation of blood loss and compared the effectiveness of web-based training as opposed to live sessions. They concluded that the expected improvement, in blood loss estimation accuracy, did not differ significantly, and that the use of both improved accuracy (20). Al-Kadri and colleagues assessed the effect of health care provider education on the accuracy of post partum blood loss estimation. They simulated 30 different blood loss stations and assessed participants, before and after educational sessions, on how to visually estimate blood loss and on the differences between the estimated blood loss and actual measure. Their result showed participants significantly underestimated post partum blood loss and the accuracy improved after training. As a result, they concluded that underestimation was more prominent in cases, where more than average excessive blood loss was simulated whereas overestimation or accurate estimations were more prominent in less than average blood loss incidents, which is consistent with our results (21). In another study, researchers aimed to determine the accuracy of the estimation of blood loss by using simulated clinical examples, in five blood loss assessment stations. Each station was numbered and was made up of a variety of equipment used in birthing suites. Over 5 liters of 'artificial' blood was made. The artificial blood had the same color and consistency of real blood. 88 participants were given a response sheet and were asked to estimate blood loss at each station. Blood in a container

(bedpan, kidney dish) was more accurately estimated than blood on sanitary pads, sheets or clothing. Lower volumes of blood were also estimated correctly by more participants than higher volumes, which is similar to the result of this study. They suggested educational programs may increase the level of accuracy and improve visual estimation of blood loss following childbirth (22). Dr. Bose and colleagues (2006) tried to determine discrepancy between actual blood loss and estimated blood loss in their observational study. They reproduced clinical scenarios in the form of 12 Objective Structured Clinical Examination (OSCE) style stations augmented with known volumes of whole blood, and individual staff members visually estimated blood loss and recorded their results. Their results depicted significant underestimation of the actual blood loss occurring in five stations and they concluded written and pictorial guidelines may help all staff members working in labor wards (3). Other researchers asked medical and nursing health care professionals to visually estimate various fluid volumes in their prospective study. Surprisingly, nurses were more accurate than doctors in their results and nurses' accuracy was influenced by fluid color but not volume, whereas the opposite was true for doctors. Doctors with more than 20 years' clinical experience significantly overestimated volumes compared to their younger colleagues. This was not true for the nursing group. They concluded that visual estimation is unreliable, and denounced using visual estimation in clinical practice (23). Furthermore, Akhlaghi and colleagues rebuilt six scenes similar of post partum hemorrhage in their descriptive observational study. They asked participations, who were educational-clinical personnel with various length of experience, in obstetrics and gynecology, to look at each scene and visually estimate volumes. Their results showed no association between work experience of participations and accuracy of volume estimation (24). Quite the contrary, our result illustrated that actual estimation in obstetric and gynecology residents in third and fourth academic years, was greater than others, and that experience is helpful in visual estimation of blood volume. In another prospective study conducted as part of the simulation-based training course, researchers adapted sophisticated mannequin simulators for obstetrical training. Results showed accuracy of blood loss estimations by a simulation-based post partum hemorrhage scenario was between 50% and 60%. This confirms our result that implementation of periodic estimations of blood loss in the management of post partum hemorrhage might improve clinical judgment (25).

The important result of our study was the accuracy of estimated blood volume, for (1500 cc) and less, before and after education; on the other hand, for (2000 cc) and more, the education-based simulation had a significant effect on the ability to visually estimate blood volume. The accurate estimation of blood volume is a skill and having this skill in emergency obstetric hemorrhage for maternal survival is essential; thus, proper education, during training, is crucial for accurate estimation of blood volume. Therefore, adding the education-based simulation is suggested for obstetrics and gynecology residents.

To reduce maternal deaths due to hemorrhage through correct blood loss estimation is a vital skill, and skills are needed to develop by education and exercise. Education via simulation is simple and inexpensive, but it has a significant positive effect on the accuracy of visual estimation of blood volume.

ACKNOWLEDGEMENT

This paper was extracted from a research proposal with research project number 89766 (26/11/2011) that was supported by a grant from Vice chancellore research of Mashhad University of Medical Sciences.

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