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Surgical treatment of uterine atony: an assessment of final year obstetrics and gynecology residents in Turkey with a questionnaire

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Summary

Purpose of investigation: The objective of this study is to assess the approaches of last-year obstetrics and gynecology (Ob&Gyn) residents towards surgical treatment of uterine atony. *Materials and Methods:* A self-administered questionnaire was used for the data collection. The questionnaire was sent to final year residents in the period from September 2013 to December 2014 through electronic mail or face-to-face conversation. *Results:* Last-year residents of Ob&Gyn preferred balloon tamponade as a first choice in nulliparous, but uterine compression suture for multiparous women in the management of uterine atony refractory to medical treatment during cesarean section. Uterine artery and internal iliac artery ligation came to forefront in the management of multiparous women. One fifth of residents did not watch any surgical intervention for uterine atony and most of them did not perform it before. *Conclusion:* The present results suggest that if residents do not perform or at least watch uterus-sparing procedures during their residency training, then a significant percentage of the residents could not perform these procedures by themselves except balloon tamponade.

Key words: Uterine atony; Balloon tamponade; Uterine compression suture; Obstetrics and gynecology resident; Questionnaire.

Introduction

Postpartum hemorrhage (PPH) is one of the leading causes of preventable maternal morbidity and mortality, and most frequently caused by uterine atony [1, 2]. The successful treatment of PPH, which is unpredictable and can occur in women with no risk factors is still a challenge for the surgeon [3, 4].

Prevention, diagnosis, and management of uterine atony is one of the essential subjects of obstetrics training. It has been demonstrated that simulation training in postpartum bleeding helps increasing the knowledge, experience, and self-confidence of the obstetricians [5, 6]. However, surgical education and training of the residents is challenging due to emergency nature of uterine atony.

The aim of the present study is to assess the approaches of last-year residents towards surgical treatment of uterine atony and to discover which procedures they assisted and/or performed, how many times, as well as to assess their self-conception about the ability to perform the procedures by themselves.

Materials and Methods

A self-administered questionnaire, designed by the first author (*BK*), consisting of 21 questions regarding the surgical management of uterine atony and two questions about demographic data was used for the data collection (Figure 1). The questionnaire was sent to Turkish senior residents who were willing to participate in the study and were in the fifth (final) year of obstetrics and gynecology (*Ob&Gyn*) program in the period from September 2013 to December 2014 through electronic mail and was required to be filled and returned electronically or with face-to-face conversation. The authors aimed to discover how many of these procedures are performed or assisted by the senior residents and whether they feel that they can perform them if necessary. The authors were blinded to the personal identity information of the participants. The ethical dimensions of this non-mandatory evaluation questionnaire were considered and no concerns were identified. All procedures performed in this study were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later ammendments or comparable ethical standards. Completion of the questionnaire was taken as implied consent to participate in this study.

The data collected were analyzed using the Statistical Package for the Social Sciences (SPSS) version 19.0. Distribution of types of interventions that can be performed by residents in case of encountering postpartum uterine atony refractory to medical therapy during cesarean section (CS) or vaginal delivery was

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QUESTIONNAIRE OF SURGICAL MANAGEMENT OF POSTPARTUM HEMORRHAGE

1. Have you ever encountered postpartum atony refractory to medical treatment during your residency?
a) I have never encountered
b) 1-3 times
c) 4-9 times
d) More than 10 times.

2. How many times have you watched postpartum ligation of the uterine artery?
a) Never
b) 1-3 times
c) 4-9 times
d) More than 10 times.

3. How many times have you performed postpartum ligation of the uterine artery?
a) Never
b) 1-3 times
c) 4-9 times
d) More than 10 times.

4. How many times have you watched hypogastric artery ligation?
a) Never
b) 1-3 times
c) 4-9 times
d) More than 10 times

5. How many times have you performed hypogastric artery ligation?
a) Never
b) 1-3 times
c) 4-9 times
d) More than 10 times

6. How many times have you watched B-Lynch or a different uterine compression suture?
a) Never
b) 1-3 times
c) 4-9 times
d) More than 10 times

7. How many times have you performed the B-Lynch or a different uterine compression suture?
a) Never
b) 1-3 times
c) 4-9 times
d) More than 10 times

8. How many times have you watched the Bakri or another balloon tamponade in postpartum uterine atony?
a) Never
b) 1-3 times
c) 4-9 times
d) More than 10 times

9. How many times have you performed the Bakri or another balloon tamponade in postpartum uterine atony?
a) Never
b) 1-3 times
c) 4-9 times
d) More than 10 times

10. How many times have you watched postpartum hysterectomy?
a) Never
b) 1-3 times
c) 4-9 times
d) More than 10 times

11. How many times have you assisted postpartum hysterectomy?
a) Never
b) 1-3 times
c) 4-9 times
d) More than 10 times

12.Which surgical intervention would you perform firstly if you have encountered postpartum atony during CS in a nulliparous woman?
a) Subtotal hysterectomy
b) Uterine balloon tamponade
c) Uterine compression suture
d) Hypogastric artery ligation
e) Uterine artery ligation

13. Which surgical intervention would you perform firstly if you have encountered postpartum atony during CS in a multiparous woman?
a) Subtotal hysterectomy
b) Uterine balloon tamponade
c) Uterine compression suture
d) Hypogastric artery ligation
e) Uterine artery ligation

14. What would you do in a nulliparous woman who developed postpartum atony refractory to medical treatment following normal delivery?
a) Laparotomy and subtotal hysterectomy
b) Laparotomy and intrauterine balloon tamponade
c) Laparotomy and uterine compression suture
d) Intrauterine balloon tamponade through vaginal route
e) Laparotomy and hypogastric artery ligation

15. What would you do in a multiparous woman who developed postpartum atony refractory to medical treatment following normal delivery?
a) Laparotomy and subtotal hysterectomy
b) Laparotomy and intrauterine balloon tamponade
c) Laparotomy and uterine compression suture
d) Intrauterine balloon tamponade through vaginal route
e) Laparotomy and hypogastric artery ligation

16. Do you believe that you could perform intrauterine balloon tamponade, if necessary?
a) Yes, I could.
b) No, I could not.

17. Could you perform bilateral uterine ligation,if necessary?
a) Yes, I could.
b) No, I could not.

18. Do you think you could perform uterine compression suture (eg: the B-Lynch) if necessary?
a) Yes, I could.
b) No, I could not.

19. Do you think you could perform hypogastric artery ligation, if necessary?
a) Yes, I could.
b) No, I could not.

20. Do you think you could perform postpartum hysterectomy, if necessary?
a) Yes, I could.
b) No, I could not.

21. Would you like to receive training on surgical treatment of postpartum atony?
Yes, very much.
No, I have adequate experience related to this subject, and 1 can perform it, if necessary.

Your gender
Female
Male

In which type of health institute do you work? (Please indicate name of the health institute, and city)

a) University hospital
b) Private university hospital
c) Training and research hospital

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Figure 1. — Questionnaire form of postpartum hemorrhage

represented by frequency tables. Participants' self-evaluation of accomplishing uterine compression suture, intrauterine balloon tamponade, ligation of uterine artery and/or hypogastric artery, and postpartum hysterectomy in case of need based on their observation, and application rates of these procedures was presented as cross-tables. Finally, the difference between the states of thinking of achievement of these procedures in case of need between residents who watched/practiced them at least once, and those who did not, was analyzed using chi-square test.

Results

Approximately 400 final year *Ob&Gyn* residents were working in the whole country at the time this study was conducted and 184 (46%) residents could have been contacted. A total of 162 residents (88%) from 35 medical centers accepted to participate in this study and filled out the questionnaire. The majority of residents were female (59.3%) and 79% of the participants were working in training hospitals, whereas the rest (21%) in university clinics.

Of the responders, 11.1% never experienced postpartum atony resistant to medical treatment, 32.7% of them saw it one to three times such a bleeding, and 56.2% experienced it more than three times. The most common first choice surgical intervention in postpartum atony during CS in a nulliparous woman was uterine balloon tamponade (41.9%) followed by uterine compression sutures (34.6%), uterine artery ligation (17.9%), hypogastric artery ligation (4.3%), and subtotal hysterectomy (1.2%). The most common first choice surgical intervention in postpartum atony during CS in a multiparous woman was uterine compression sutures (38.3%) followed by uterine artery ligation (32.1%), hypogastric artery ligation (15.4%), subtotal hysterectomy (8.6%), and uterine balloon tamponade (5.6%). The most common first choice surgical intervention in postpartum atony after vaginal delivery in a nulliparous woman was intrauterine balloon insertion from the vagina (63%) followed by uterine compression sutures (18.5%), laparotomy and intrauterine balloon insertion (9.9%), hypogastric artery ligation (6.8%), and subtotal hysterectomy (1.9%). The most common first choice surgical intervention in postpartum atony after vaginal delivery in a multiparous woman was intrauterine balloon insertion from the vagina (58.5%), followed by uterine compression sutures (15.4%), subtotal hysterectomy (10.5%), laparotomy and intrauterine balloon insertion (8%), and hypogastric artery ligation (7.4%).

The rates of observation and/or performance of surgical treatment modalities for postpartum atony are presented in Table 1. The most common performed procedure performed by residents was subtotal hysterectomy (56%), whereas the most common uterus sparing surgical method was the Bakri balloon tamponade (34%). The other methods were performed by residents in lower rates.

The percentage of those who thought to perform or refrain from performing surgical treatment methods used for the management of postpartum uterine atony among participants who watched or did not watch these procedures are presented in Table 2. The rate of positive answers was significantly higher in watched group compared to did-not-watch group in uterine compression sutures, intrauterine balloon tamponade, uterine artery ligation, and subtotal hysterectomy groups, whereas significantly lower in hypogastric artery ligation group ($p < 0.001$ in all groups). The rate of negative answers was significantly higher in did-not-watch group compared to watched group in uterine compression sutures, hypogastric artery ligation, uterine artery ligation, and subtotal hysterectomy groups, whereas significantly lower in intrauterine balloon tamponade group ($p < 0.001$ in all groups).

The rates of residents who had already applied uterine compression sutures, the Bakri balloon tamponade, uterine, and/or hypogastric artery ligation, and subtotal hysterectomy at least once and stated that they could perform these procedures in the future were 100%, 88.9%, 97.7%, 88.9%, and 84.6% of the residents, respectively, and these rates were significantly higher than did-not-perform group ($p < 0.001$ in all groups) (Table 3). Eighty-one percent of the residents who have never applied the Bakri balloon tamponade stated that they could perform it in the future. More than half of the residents who had never applied uterine compression sutures or uterine artery ligation stated that they could perform it in the future, whereas this rate was much lower among hypogastric artery ligation and postpartum hysterectomy groups (Table 3). Finally, 156 (96%) residents indicated the need of additional training for postpartum uterine atony.

Table 1. — *The number of surgical procedures watched and/or performed by participants applied for the treatment of the cases with uterine atony refractory to medical treatment.*

Treatment option	Watched			Performed		
	Never	1-3 times	> 3 times	Never	1-3 times	> 3 times
Uterine compression sutures	32.1%	54.9%	13%	83.3%	13.6%	3.1%
Intrauterine balloon tamponade	22.2%	47.5%	30.3%	66.1%	28.4%	5.6%
Hypogastric artery ligation	27.2%	53.7%	19.1%	83.3%	15.4%	1.2%
Uterine artery ligation	31.5%	52.5%	16.0%	73.5%	24.7%	1.9%
Subtotal hysterectomy	20.4%	56.2%	23.5%	43.8%	43.8%	12.4%

Table 2. — *The rate of residents who thought to perform or refrain from performing surgical treatment methods used for the management of postpartum uterine atony among participants who watched or did not watch these procedures.*

Treatment modality		Yes, I could n (%)	No, I could not n (%)	X^2	*p* value
Uterine compression sutures	Watched	90 (81.8%)	20 (18.2%)	49.23	<0.001
	Did not watch	13 (25%)	39 (75%)		
Intrauterine balloon tamponade	Watched	118 (93.7%)	8 (6.4%)	18.84	<0.001
	Did not watch	24 (66.7%)	12 (33.3%)		
Hypogastric artery ligation	Watched	46 (38.9%)	72 (61%)	11.33	<0.001
	Did not watch	5 (11.4%)	39 (88.6%)		
Uterine artery ligation	Watched	93 (83.8%)	18 (16.2%)	26.73	<0.001
	Did not watch	22 (44%)	28 (56%)		
Subtotal hysterectomy	Watched	99 (76.7%)	30 (23.3%)	14.67	<0.001
	Did not watch	14 (42.4%)	19 (57.6%)		

$p < 0.01$ is statistically significant

Table 3. — *The percentage of residents who stated to perform or refrain from performing surgical treatment methods used for the management of postpartum uterine atony in the future among participants who previously performed or did not perform these procedures.*

Treatment modality		Yes, I could n (%)	No, I could not n (%)	X^2	*p* value
Uterine compression sutures	Performed	24 (88.9%)	3 (11.1%)	8.96	<0.001
	Did not perform	79 (58.5%)	56 (41.4%)		
Intrauterine balloon tamponade	Performed	55 (100%)	0	11.73	<0.001
	Did not perform	87 (81.3%)	20 (18.7%)		
Hypogastric artery ligation	Performed	24 (88.9%)	3 (11.1%)	49.5	<0.001
	Did not perform	27 (20%)	108 (80%)		
Uterine artery ligation	Performed	42 (97.7%)	1 (2.3%)	20.24	<0.001
	Did not perform	73 (61.3%)	46 (38.7%)		
Subtotal hysterectomy	Performed	77 (84.6%)	14 (15.4%)	21.74	<0.001
	Did not perform	36 (50.7%)	35 (49.3%)		

$p < 0.01$ is statistically significant

Discussion

In the present study, the authors detected that residents most frequently preferred intrauterine balloon tamponade (42%), and application of uterine compression sutures (35%) in nulliparous women, and uterine compression suture (38%), and uterine artery ligation (32%) in multiparous women with treatment-refractory uterine atony.

Balloon tamponade ranks top among treatment options in the management of nulliparous women with uterine atony. Its prevalent use can be explained by non-invasiveness of intrauterine balloon application, which preserves uterine integrity [7-9], and potentially lower long-term adverse effect on fertility [10]. The uterine compression suture is preferred by residents in similar rates to balloon tamponade in the present study and this tendency can be explained by similar success rates with balloon tamponade reported in the literature and rapid application of the suture without requirement of special material [7, 9].

In the present study, results of the management of uterine atony of multiparous women were very surprising. Uterine compression suture (38%) and uterine artery ligation (32%) ranked on top, while the Bakri balloon tamponade (6%) was the least applied method, which might be related to the desire to obtain faster results with rapidly employed methods in multiparous women. In the authors' previous study [9] where they compared the Bakri balloon tamponade (*n=21*) with the B-Lynch suturing (*n=24*), the Bakri balloon tamponade increased operation time compared to the B-Lynch suturing (107±38 *vs.* 81±19 minutes, $p = 0.01$). One of the reasons why uterine compression sutures are preferred in multiparous women may depend on the easy application of the method without the need of special material. The senior residents did not prefer time-consuming but least invasive Bakri balloon tamponade in multiparous women as much as nulliparous women (6% *vs.* 42%). Development of potential short- and long-term complications such as uterine necrosis, and intra-abdominal adhesions following compression sutures reported in recent years are raising concerns about this procedure [11-13], especially when it is combined with vessel ligation [14]. Making a hysterectomy decision may be easier in multiparous compared to nulliparous women because of the fear from uterine necrosis risk.

In the present study, the authors detected that uterine artery ligation was more frequently used in multiparous women (nulliparous 18% *vs.* multiparous, 32%) which might be related to concerns about adverse effects of uterine artery ligation on fertility in nulliparous women. Nonetheless these concerns can be inconsequential since adverse effects of uterine artery ligation or uterine devascularization on fertility have not been demonstrated, unless suspensory ligament of ovary is not ligated [15].

In the present study, internal iliac artery ligation (IIAL) was one of the least preferable techniques coming as no surprise. Last-year residents demonstrated that when compared with nulliparous women, they might prefer to try IIAL which can have relatively lower effectiveness in addition to its risk in uterine atony [16] in multiparous women for whom hysterectomy decision can be easily made (4% *vs.* 15%). IIAL is challenging for obstetricians who are not accustomed to retroperitoneal anatomy. Besides IIAL is challenging even for an experienced pelvic surgeon, especially when there is a large uterus, a transverse lower ab-

dominal incision, ongoing pelvic hemorrhage, or the patient has a high body mass index [17]. In a bulletin released by ACOG in 2006, preference of the bilateral uterine artery ligation rather than IIAL was recommended [18].

In the present study, in the management of 9% of multiparous, but only 1% of nulliparous women as a first intervention, subtotal hysterectomy was contemplated. These results can be explained with the desire to perform '*life-saving'* postpartum hysterectomy without trying fertility preserving methods and wasting time in multiparous women rather than nulliparous women.

In the present questionnaire survey, the most frequently preferred method was intrauterine balloon tamponade applied through vaginal route for the management of uterine atony developed following vaginal deliveries in 63 % of nulliparous, and 59% of multiparous women, in accordance with the ACOG recommendations: When medical treatment fails to control the hemorrhage after vaginal delivery, tamponade of the uterus can be effective in decreasing hemorrhage secondary to uterine atony [18].

In the management of uterine atony following vaginal birth most frequently preferred second method was laparotomy, and uterine compression suture in 19% of nulliparous, and 15% of multiparous women. Uterine compression sutures can be applied after vaginal birth through laparotomy incision [19] however before deciding for laparotomy, trial of a less invasive alternative as balloon tamponade will be an appropriate approach. In women unresponsive to intrauterine balloon application other surgical approaches should be performed [18].

In the present questionnaire survey, among conservative treatment modalities for medical treatment refractory uterine atony, uterine balloon tamponade was most frequently applied method. Nearly one-third of the last-year residents reported that they had performed this method at least once. Only nearly one-fifth of them stated that they had applied other methods including uterine compression suture, uterine artery, and hypogastric artery ligation at least once during their residency. Still nearly half of them had never applied life-saving postpartum hysterectomy, which demonstrate deficiencies in emergency obstetric training. Most of the residents graduate without application of any intervention related to postpartum bleeding during their residency training. At this point, the necessity, and significance of training about postpartum bleeding during residency and post-graduate period becomes prominent.

Straub *et al.* [6] carried out a study about an educational program consisting of a lecture and high-fidelity simulation exercise for *Ob&Gyn* and family medicine residents. After completing the program, significant improvements in diagnosis and management of postpartum hemorrhage was reported by the residents [6].

Deering *et al.* [5] designed a postpartum hemorrhage simulation scenario using the Noelle birthing mannequin and the uterine hemorrhage model included with it. *Ob&Gyn* residents were evaluated for recognizing the hemorrhage and taking appropriate steps, including asking the assistant to administer medications. Forty residents underwent simulation training. The majority was unable to correct the hemorrhage within five minutes and almost half of them also made at least one error, either the dose or route, in the medications they requested. However, Deering *et al.* [5] did not evaluate their surgical skills.

Contrary to higher rates of self-confidence with other methods, only 39% of the participants stated that they could perform hypogastric artery ligation even though they had watched it before. This outcome is not so surprising since application of hypogastric artery ligation in case of an emergency is technically challenging. Among these procedures, intrauterine balloon application could be thought by most of the surgeons to be performed when it was watched only once.

Interesting results have emerged in the group who never watched these applications. The residents in did-not-watch group reported that they could perform intrauterine balloon tamponade (67%) even without watching this procedure previously, whereas these rates were lower in uterine artery ligation (44%), uterine compression sutures (25%), and hypogastric artery ligation (11%) groups. Therefore other uterus sparing surgical interventions apart from the balloon tamponade could not be performed by the majority of the residents without watching these procedures before. These results suggest that if residents do not perform or at least watch these procedures during their residency, then they could not perform these interventions by themselves.

Nearly half of the residents who had not performed postpartum hysterectomy thought that they would not perform hysterectomy. Even though technically, peripartum hysterectomy appears to be quite similar to gynecological hysterectomy, important differences exist between these two operations. Under emergency conditions, faster removal of an actively bleeding gravid uterus from a hypervascularized pelvis in a woman with deteriorated hemodynamic state is more difficult than hysterectomy performed under elective conditions. Compared with gynecologic hysterectomy, peripartum hysterectomy has higher rates of urological complication as bladder, and ureteral injuries, need for reoperation, blood loss, wound site complications, and venous thromboembolism [20]. These findings demonstrate that postpartum hysterectomy should have an important place in the training of residents.

As expected, the rate of residents who stated that they could perform these procedures was significantly higher in watched and/or performed groups compared to did-not-watch and/or did-not-perform groups. More than 84% of the residents, who had performed these procedures before, stated they could perform all of them later. However, the rates of ability to perform these procedures, especially hypogastric artery ligation (20%), and postpartum hysterectomy (50%) dramatically dropped in residents who had not

performed these operations before. Based on these data, it has been revealed that participation of residents in emergency obstetric surgery during their training period is very important for realization of these procedures when they become an *Ob&Gyn* consultant. According to the results of the present study, even only watching surgical methods applied in uterine atony carry utmost importance.

Conclusion

This questionnaire survey revealed that last-year residents of *Ob&Gyn* preferred balloon tamponade as a first choice in nulliparous, but uterine compression suture for multiparous women in the management of uterine atony refractory to medical treatment during CS. For the management of uterine atony refractory to medical treatment after vaginal birth, they preferred balloon tamponade as a first-line treatment in both nulliparous and multiparous women. Arterial ligations like uterine artery and hypogastric artery ligation came to forefront in the management of multiparous women. Hypogastric artery ligation was perceived as a challenging method as expected.

The present results suggest that if residents do not perform or at least watch uterus-sparing procedures during their residency training, then a significant percent of the residents could not perform these procedures by themselves except balloon tamponade. Unfortunately, 20% of the last-year residents had not watched the life-saving surgical procedure "postpartum hysterectomy" in the treatment of uterine atony, and 44% of them had never performed it. Nearly half of the residents who had not performed postpartum hysterectomy stated that they could not perform life-saving hysterectomy.

Ninety-six percent of the last-year residents who participated in the questionnaire survey wanted to receive training about the management of uterine atony. These results indicate that during residency of *Ob&Gyn*, residents should be given further training in emergency obstetric surgery.

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