

Clinical Research

Conservative Management of Postpartum Uterine Atony with Intrauterine Balloon Tamponade

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ABSTRACT

Objective: Uterine atony is one of the serious complications of labour. Hysterectomy is mostly required in acute cases. Conservative management with intrauterine balloon insertion alone or in combination with B-Lynch suture might be an alternative. We report a case series from a referral hospital.

Material and Method: This was a retrospective analysis of 30 postpartum uterine atony cases refractory to uterotonic treatment and managed with intrauterine balloon tamponade with or without B-Lynch suture.

Results: Thirty cases managed with intrauterine Bakri balloon tamponade (BBT) with or without B-Lynch compression suture. Our success rate was 86 %. Median estimated blood loss was 1850 ml, intraoperative median hemoglobin was 6.6 mg/dl, median amount of blood transfused was four units, median operation duration was 70 minutes, median volume infused into balloon was 250 ml, balloon was in place for a median duration of 30 hours. In 4 cases Bakri balloon tamponade with or without B-Lynch compression sutures failed to stop hemorrhage and hysterectomy required. In one patient Asherman's syndrome and infertility developed. In cases which BBT was successful PI values of bilateral uterine artery doppler was similar to control group. There wasn't maternal mortality.

Conclusion: Balloon tamponade of uterus with or without compression sutures is an effective, quick, simple and fertility preserving technique in the management of postpartum uterine atony bleeding. It further provides time for more complicated interventions in case of failure to control hemorrhage.

Keywords: Uterine Atony, Bakri Balloon, Intrauterine Balloon Tamponade, B-Lynch Suture.

ÖZET

Postpartum Uterin Atonide İntrauterin Balon Tamponad ile Konservatif Yaklaşım

Amaç: Uterin atoni doğumun ciddi bir komplikasyonudur. Akut olgularda çoğunlukla histerektomi yapılır. B-Lynch sütürü ile birlikte veya tek başına intrauterin balon uygulanması konservatif yaklaşımı ise bir diğer alternatiftir. Bölge hastanesinden olgu serisi sunulmuştur.

Gereç ve Yöntem: Bu çalışmada uterotonik tedaviye cevapsız ve B-Lynch sütürü ile birlikte veya tek başına intra uterin balon tamponad ile tedavi edilen otuz postpartum uterin atoni olgusu retrospektif olarak analiz edilmiştir.

Bulgular: Otuz olguya B-Lynch kompresyon sütürü ile veya tek başına bakri balon tamponad (BBT) uygulandı. Başarı oranı % 86, ortalama kan kaybı 1850 ml, intraoperatif ortalama hemoglobin değeri 6,6 mg/dl, ortalama kan transfüzyonu 4 ünite, ortalama ameliyat süresi 70 dakika, balona verilen ortalama sıvı 250 ml, balonun çıkarılma süresi ortalama 30 saat idi. Dört olgu kanamanın durmaması sebebiyle histerektomiye alındı. Bir olguda Asherman sendromuna bağlı infertilite oluştu. BBT 'in başarılı olduğu olgularda bilateral uterin arter doppler PI değeri, kontrol grubuyla benzerdi. Maternal mortalite olmadı.

Sonuç: B-lync sütürüyle beraber veya tek başına uygulanan balon tamponad, postpartum atoni kanamasında etkili, hızlı, basit, ve fertilitte koruyucu bir tekniktir. Kanama kontrolünde başarısızlık durumunda daha ileri müdahaleler için ilave zaman sağlamaktadır.

Anahtar Sözcükler: Uterin Atoni, Bakri Balon, İntrauterin Balon Tamponad, B-Lynch Sütür.

Postpartum hemorrhage (PPH) is still one of the most critical complications of labour worldwide. Effective interventions alternative to hysterectomy in acute cases are needed to reduce maternal mortality. The most prevalent cause of PPH is uterine atony (1). The first step in the management of uterine atony is medical treatment with uterotonics, uterine massage and immediate blood replacement (2-4). Surgical intervention becomes vital when conservative methods fail or in hemodynamic instability. Conventional surgical techniques include uterine artery ligation, internal iliac

artery ligation and hysterectomy (3, 5). These procedures require surgical expertise and hysterectomy means irreversible loss of fertility. Therefore, effectiveness of conservative management options should be sought. Uterine balloon insertion (internal tamponade) with or without uterine compression sutures (external tamponade) might be considered before hysterectomy (2, 5-7). This conservative approach further provides time to prepare for more complicated surgical interventions or transportation to an experienced centre. We present our postpartum uterine atony cases refractory to

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medical treatment and managed with Bakri balloon tamponade alone or in combination with B-Lynch compression suture (sandwich method) successfully.

MATERIAL AND METHOD

All postpartum uterine atony cases managed in our clinic between December 2011 and December 2015 were reviewed retrospectively. For this study, the approval was obtained from Fırat University Faculty of Medicine Non-Interventional Research Ethics Committee. Cases managed with intrauterine Bakri balloon insertion with or without sandwich method were evaluated. Data was retrieved about age, gravida, parity, gestational week, risk factors for uterine atony, type of delivery, estimated total blood loss, intraoperative hematocrit values, amount of blood transfused, inflation volume of Bakri balloon, duration of time Bakri balloon remained in uterus, complication rate and analysed.

Postpartum uterine atony was defined when PPH of approximately 500 ml occurred following vaginal birth and 1000 ml following C-section together with poor uterine contractions (8). Uterine atony cases refractory to uterine massage and medical treatment with uterotonics were managed with intrauterine Bakri balloon insertion alone or in combination with B-Lynch uterine compression suture (sandwich method). B-Lynch sutures were done as described by B-Lynch in 1997 (9). Bakri balloon (Cook Medical, Bloomington, US) was inserted to the uterus as previously described (10). Following balloon placement in the uterus during C-section, distal end of the balloon shaft was advanced to the vagina through the cervix and pulled out of the vagina by an assistant. Balloon was infused with sterile saline with 50 ml increments. In cases of persistent bleeding, balloon was removed, B-Lynch compression suture was placed and balloon was reinserted and infused with saline, again with 50 ml increments (9, 11). By cases when this approach was not able to stop the bleeding, we administered hysterectomy. Because of the massive bleeding bilateral internal iliac artery ligation wasn't applied in patients which hysterectomy was administered. In uterine atony cases following vaginal delivery, intrauterine Bakri balloon was placed under ultrasound guidance and infused with sterile saline (12). Second generation cephalosporins were used for antibiotic prophylaxis. In the first postoperative 24-hour, urine output, arterial blood pressure (mmHg), heart rate (/min) and fever (°C) were measured hourly. Balanced fluids were administered and 10 units of oxytocin was added to each 500 ml fluid, and 0.2 mg methylergonovine maleate was administered i.m. twice daily. Gauze bandages used for bleeding control was weighed after the operation and the drained blood in the aspirator were evaluated in order to estimate the amount of intraoperative hemorrhage. In the first 24-hour postoperative period, the amount of blood collect-

ed in the drainage bag from the Bakri balloon and the weight of pads placed in the perineum were measured. All cases were recalled between 2-4 years after birth. Menstrual irregularities of the cases and pregnancy were investigated. If they were pregnant again the fate of their pregnancy was questioned. Bilateral uterine artery doppler ultrasonography (usg) examination was examined in patients and compared with control group. As a control group to compare uterine artery doppler usg results 30 multiparous woman without a uterine or ovarian pathology were randomly selected.

Uterine artery doppler evaluation: Usg was performed with transvaginal usg (voluson E6 GE Healthcare Technologies, Milwaukee, WI, USA) in the position of lithotomy in the follicular phase. From the sagittal position of the uterus where the cervical canal was seen, the probe was slowly turned to the lateral and the flow of the right and left uterine arteries was determined by color flow doppler from internal cervical os. Pulse wave doppler sampling interval was automatically measured in a range of 2 mm, insertion angle 30 degrees. Right and left uterine artery PI values were measured.

Descriptive statistics were used to analyse the data. Median and mean values were presented for the variables analysed. For the statistical analysis of the data, definitive statistics was carried out with SPSS 21.0 (SPSS Inc. IL, USA). Mann-Whitney U test was used in the comparison between the groups. Values of $p < 0.05$ were considered significant.

RESULTS

Demographic characteristics of the cases were presented in (Table 1). In 22 cases intrauterine Bakri balloon was administered alone and in the remaining eight cases, Bakri balloon tamponade and B-Lynch compression suture (sandwich method) was concurrently used. 26 of the cases (86%) were delivered by C-section and the remaining four (14%) had normal vaginal birth. Median estimated blood loss was 1850 ml (range 1100-3100 ml), median blood needed for transfusion was 4 units (range 0-8 units), (Table 1).

Table 1. Demographic and clinical characteristics of the patients.

Variable	Median values	Range	Mean values
Age (years)	32	20-43	31.2
Gravida, n	2	1-5	2.1
Parity, n	1	0-4	1.1
Gestational week at birth (n)	37	30-41	35.5
Delivery by C-section (%)	86		
Lowest Hb value	6.6	5-9.7	6.7
Estimated blood loss (ml)	1850	1100-3100	1973
Blood needed for transfusion (units)	4	0-8	4
Volume infused into the balloon (ml)	250	80-500	271
Duration of time balloon remained in the uterus (hours)	30	12-36	31.8
Procedure duration (minutes)	70	20-120	66.6
Hospitalization duration (days)	3.5	2-7	3.6

The main risk factors for uterine atony were induction of labor (33 %), advanced maternal age (20 %), Mg SO⁴ treatment (20 %), preeclampsia (16%) and unprogressive labor (16 %) in our cases. Risk factors existent in our cases for postpartum uterine atony are given in (Table 2). Postpartum follow-up results were shown in (Table 3).

Table 2. Risk factors for uterine atony in patients included in the study.

Risk factor	n	%
Induction of labour	10	33
Advanced maternal age	6	20
MgSO ⁴ treatment	6	20
Preeclampsia	5	16
Obstructed labour	5	16
Polyhydramnios	3	10
Fetal distress	3	10
Placenta previa	2	6
Ablatio placenta	1	3

Table 3. Postpartum follow-up results of all cases.

Morbidity	Sandwich method applied cases (n=8)	Only Bakri balloon applied cases (n=22)
Hysterectomy applied cases	2	2
DIC	-	1
Bladder injury	-	1
Asherman's syndrome	1	-
Abortus	-	-
Menstruel disorders	1	-
Term pregnancy	2	6

Median operation time was 70 minutes (range 20-120 minutes), the median volume infused into the balloon was 250 ml (range 80-500 ml), the balloon was in place for a median duration of 30 hours (range 12-36 hours). Bakri balloon tamponade with or without uterine sandwich method were successful in-26 cases of 30 (86 %). In 22 cases (74 %) only Bakri balloon, in 8 cases (26 %) Bakri balloon was applied together with B-Lynch compression sutures. Whereas totally 4 cases (13%), 2 cases in Bakri balloon tamponade applied and 2 cases in sandwich method applied failed to stop postpartum atony hemorrhage. Peripartum hysterectomy was needed in four cases. In one case disseminated intravascular coagulopathy occurred due to massive bleeding and in one case bladder injury occurred during hysterectomy. There wasn't any mortality.

In 8 of 26 patients which fertility was preserved, pregnancy occurred during follow up 1-3 years and pregnancies were terminated as term healthy live births. Amenorrhea and infertility developed in a case where the sandwich method was applied and the balloon was inflated with 350 ml. In Hysteroscopic examination there was a severe Asherman's syndrome in that patient. In other cases which sandwich method applied the balloon was inflated at a pressure of 200 ml or less. In 2 cases tubal ligation was applied. Other patients reported that they did not think about pregnancy for the time being and they were using one of contraception

methods. While 25 cases didn't have any severe complaint about menstrual disorders, only one case had a complaint of amenorrhea which sandwich method was applied (Table 3).

Comparison of uterine artery doppler results: PI values of right uterine artery in atony group was 3.52±0.83, while 3.38 ± 0.87 in the control group (p:0.47). PI values of left uterine artery in atony group was (3.54±0.84), while (3.24 ± 0.93) in the control group (p: 0.227). There was no significant difference between the two groups in the flow measurements of the doppler usg (p>0.05).

DISCUSSION

We found the success rate of BBT as 86% in the management of postpartum uterine atony in fertility preserving management option. This ratio is compatible with the 70-100% rates reported in the literature (6, 10, 11, 19, 20). Since it is a retrospective case series and the absence of a control group are the limitations of our study.

Recently, intrauterine balloon insertion was suggested to be included in the treatment protocol for PPH (13-15). In Hong Kong, intrauterine balloon tamponade for the management of massive postpartum hemorrhage is in use as part of obstetric training (16). Various balloons such as condom, Sengstaken-Blakemore tube, Foley, Rusch or Bakri catheter are in use for uterine tamponade (17). Bakri balloon is specially designed to be inserted into the uterine cavity which is infused with liquid up to 500 ml and effective in controlling acute PPH refractory to medical treatment. The lumen at the center of the catheter provides the drainage of blood which enables the detection of ongoing bleeding (10). The mechanism of action of BBT is still not well understood. It has been speculated that the balloon acts by raising the intrauterine pressure to a greater pressure than the systemic arterial pressure (18).

In the literature, case series were reported describing the effectiveness of uterine balloon tamponade with various balloon types in acute postpartum hemorrhage unresponsive to medical treatment (16). Success rates in preventing hysterectomy were between 70-100 %. In some reports analysing only uterine atony cases, 100 % success rate was presented (19). Similarly, 80-100 % success rates were reported in case series which combined the uterine compression sutures with Bakri balloon tamponade for the treatment of uterine atony (6, 7, 10, 11, 20). UBT might be combined with other conservative techniques like external uterine compression sutures or endouterine square hemostatic sutures. Bakri balloon is probably the least invasive conservative management modality for acute postpartum hemorrhage and convenient for both transvaginal and trans-abdominal insertion, immediately reduces bleeding and decreases the need for more aggressive procedures such as hysterectomy (21). Therefore, uterine balloon tamponade is recommended as the first step in the

management of postpartum hemorrhage (22- 24). We performed BBT as the first step in 22 cases of 30 cases of uterine atony who did not respond to medical treatment in our clinic. Two of these cases required emergency hysterectomy. Sandwich method was applied to 8 cases. In two of these cases there was a failure and hysterectomy was required.

Uterine compression sutures and intrauterine balloon tamponade are defined as fertility preserving management options in PPH and both of those techniques were suggested to be combined in order to apply pressure on the surface of myometrium both internally (Bakri balloon) and externally (B-Lynch suture) (8, 9, 11, 25-27). Yoong et al. (20) similarly suggested that sandwich technique is a simple and quick surgical technique that can be used especially for the treatment of atonic postpartum hemorrhage in infiltrating placenta praevia. Vitthala et al. (6) reported the success rate of sandwich method as 100 % in vaginal delivery and 57 % in cesarean section birth. This method fails mostly in abnormal placentation cases such as placenta previa and placenta accrete. In our series, we used Bakri balloon together with B-Lynch compression suture in eight cases. In 2 of these cases this method failed and hysterectomy was required. In 1 case Asherman's syndrome developed which resulted in amenorrhea and infertility. In this case the balloon inflation volume was 350 ml. When B-Lynch sutures and BBT applied together, that inflated volume may cause more ischemia in endometrium and myometrium which leads to Asherman's syndrome. The other balloon inflation volumes that we applied during sandwich method were 200 ml or less.

REFERENCES

1. Tindell K, Garfinkel R, Abu-Haydar E, et al. Uterine balloon tamponade for the treatment of postpartum hemorrhage in resource-poor settings: a systematic review. *BJOG* 2013; 120: 5-14.
2. Ahonen J, Stefanovic V, Lassila R. Management of postpartum haemorrhage. *Acta Anaesthesiol Scand* 2010; 54: 1164-78.
3. Doumouchtsis SK, Papageorghiou AT, Arulkumaran S. Systematic review of conservative management of postpartum hemorrhage: what to do when medical treatment fails. *Obstet Gynecol Surv* 2007; 62: 540-7.
4. Mousa HA, Walkinshaw S. Major postpartum haemorrhage. *Curr Opin Obstet Gynecol* 2001; 13: 595-603.
5. Chandraran E, Arulkumaran S. Surgical aspects of postpartum haemorrhage. *Best Pract Res Clin Obstet Gynaecol* 2008; 22: 1089-102.
6. Vitthala S, Tsoumpou I, Anjum ZK, Aziz NA. Use of Bakri balloon in postpartum haemorrhage: A series of 15 cases. *Aust NZJ Obstet Gynaecol* 2009; 49: 191-4.
7. Diemert A, Ortmeier G, Hollwitz B et al. The combination of intrauterine balloon tamponade and the B-Lynch procedure for the treatment of severe postpartum hemorrhage. *Am J Obstet Gynecol* 2012; 206: 65.
8. McDonald S. Management of the third stage of labour. *Journal of Midwifery & Women's Health*. 2007; 52: 254-61.
9. B-Lynch C, Coker A, Lawal AH, Abu J, Cowen MJ. The B-Lynch surgical technique for the control of massive postpartum haemorrhage: an alternative to hysterectomy? Five cases reported. *BJOG* 1997; 104: 372-5.
10. Bakri YN, Amri A, Abdul Jabbar F. Tamponade balloon for obstetrical bleeding. *Int J Gynaecol Obstet* 2001; 74: 139-42.
11. Nelson WL, O'Brien JM. The uterine sandwich for persistent uterine atony: combining the B-Lynch compression suture and an intrauterine Bakri balloon. *Am J Obstet Gynaecol* 2007; 196: 9-10.

12. Cho Y, Rizvi C, Uppal T, Condous G. Ultrasonographic visualization of balloon placement for uterine tamponade in massive primary postpartum hemorrhage. *Ultrasound Obstet Gynecol* 2008; 32: 711-3.
13. Varatharajan L, Chandrarahan E, Sutton J, Lowe V, Arulkumaran S. Outcome of the management of massive postpartum hemorrhage using the algorithm "HEMOSTASIS". *Int J Gynaecol Obstet*. 2011; 113: 152-4.
14. Rath W, Hackethal A, Bohlmann MK. Second-line treatment of postpartum haemorrhage (PPH). *Arch Gynecol Obstet* 2012; 286: 549-61.
15. Royal College of Obstetricians and Gynaecologists. RCOG Draft Guideline. Prevention and management of postpartum haemorrhage, 2008.
16. Kong MC, To WW. Balloon tamponade for postpartum haemorrhage: case series and literature review. *Hong Kong Med J* 2013; 19: 484-90.
17. Georgiou C. Balloon tamponade in the management of postpartum haemorrhage: a review. *Br J Obstet Gynaecol* 2009; 116: 748-57.
18. Condous GS, Arulkumaran S, Symonds I, Chapman R, Sinha A, Razvi K. The 'tamponade test' in the management of massive postpartum hemorrhage. *Obstet Gynecol* 2003; 101: 767-72.
19. Dabelea V, Schultze PM, McDuffie RS. Intrauterine balloon tamponade in the management of postpartum hemorrhage. *Am J Perinatol* 2007; 24: 359-64.
20. Yoong W, Ridout A, Memtsa M, et al. Application of uterine compression suture in association with intrauterine balloon tamponade ('uterine sandwich') for postpartum hemorrhage. *Acta Obstet Gynecol Scand* 2012; 91: 147-51.
21. Aibar L, Aguilar MT, Puertas A, Valverde M. Bakri balloon for the management of postpartum hemorrhage. *Acta Obstet Gynecol Scand* 2013; 92: 465-7.
22. Doumouchtsis SK, Papageorghiou AT, Vernier C, Arulkumaran S. Management of postpartum hemorrhage by uterine balloon tamponade: prospective evaluation of effectiveness. *Acta Obstet Gynecol Scand* 2008; 87: 849-55.
23. Nagai S, Kobayashi H, Nagata T, Hiwatashi S, Kawamura T, Yokomine D, Orita Y, Oki T, Yoshinaga M, Douchi T. Clinical Usefulness of Bakri Balloon Tamponade in the Treatment of Massive Postpartum Uterine Hemorrhage. *Kurume Med J* 2016; 62: 17-21.
24. Pendleton AA, Natarajan A, Ahn R, Nelson BD, Eckardt MJ, Burke TF. Emergency hysterectomy for uncontrolled postpartum hemorrhage may be averted through uterine balloon tamponade in Kenya and Senegal. *Int J Gynaecol Obstet* 2016; 133: 124.
25. Hayman RG, Arulkumaran S, Steer P. Uterine compressions sutures: surgical management of postpartum haemorrhage. *Obstet Gynecol* 2002; 99: 502-6.
26. Danso D, Reginald P. Combined B-Lynch suture with intrauterine balloon catheter triumphs over massive postpartum haemorrhage. *BJOG* 2002; 109: 963.
27. Price N, Whitelaw N, B-Lynch C. Application of the B-Lynch brace suture with associated intrauterine balloon catheter for massive haemorrhage due to placenta accreta following a second trimester miscarriage. *J Obstet Gynaecol* 2006; 26: 267-8.
28. Diemert A, Ortmeyer G, Hollwitz B, et al. The combination of intrauterine balloon tamponade and the B-Lynch procedure for the treatment of severe postpartum hemorrhage. *Am J Obstet Gynecol* 2012; 206: 65.
29. Sentilhes L, Gromez A, Razzouk K, Resch B, Verspyck E, Marpeau L. B-Lynch suture for massive persistent postpartum hemorrhage following stepwise uterine devascularization. *Acta Obstet Gynecol Scand* 2008; 87: 1020-6.
30. Gezginç K, Yazici F, Koyuncu T. Results of hysterosalpingogram in women with previous B-Lynch suture. *Int J Gynaecol Obstet* 2011; 115: 68-9.
31. Sugawara J, Saito M, Nishigori H, et al. Fertility and pregnancy outcomes following B-Lynch sutures for post-partum hemorrhage. *J Obstet Gynaecol Res* 2015; 41: 559-64.
32. Goojha CA, Case A, Pierson R. Development of Asherman syndrome after conservative surgical management of intractable postpartum hemorrhage. *Fertil Steril* 2010; 94: 1098.
33. Begum J, Pallave P, Ghose S. B-lynch: A technique for uterine conservation or deformation? A case report with literature review. *J Clin Diagn Res* 2014; 8: OD01-OD03.
34. Liu S, Mathur M, Tagore S. Complications and pregnancy outcome following uterine compression suture for postpartum haemorrhage: a single centre experience. *J Obstet Gynaecol* 2014; 34: 383-6.
35. Rasheed SM, Amin MM, Abd Ellah AH, Abo Elhassan AM, El Zahry MA, Wahab HA. Reproductive performance after conservative surgical treatment of postpartum hemorrhage. *Int J Gynaecol Obstet* 2014; 124: 248-52.