International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Damor P et al. Int J Reprod Contracept Obstet Gynecol. 2021 Nov;10(11):4150-4156
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20214324

Original Research Article

Role of SR vacuum cannula as novel technique for atonic PPH management study at Pannadhay Rajkiya Mahila Chikitsalaya and RNT Medical College, Udaipur

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Received: 20 September 2021
Accepted: 11 October 2021

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ABSTRACT

Background: Postpartum hemorrhage is a major obstetrical emergency and one of the important but preventable causes of maternal morbidity and mortality. It is often sudden, frequently unpredictable and catastrophic. In this study SR vacuum cannula will be applied to create negative pressure inside the uterine cavity with a specially designed uterine cannula, which is a simple, safe and cost-effective technique. The aim and objective of the study was to analyse the incidence, effectiveness of suction cannula in management of atonic PPH after failure of medical management over tamponade and the maternal outcome after suction technique.
Methods: This observational study was conducted in Department of Obstetrics and Gynecology, RNT Medical College and Panna Dhay Rajkiya Mahila Chikitsalaya, Udaipur, Rajasthan. Patients requiring PPH management admitted to the obstetrics ward between August 2019 – December 2020. The Uterine Vacuum Retraction System consists of SR Suction cannula to control PPH after vaginal delivery. SR suction cannula for atonic PPH at caesarean delivery and High vacuum suction machine was used.
Results: In majority of the patients bleeding was stopped within three minutes. 60 women (50%) bleeding was stopped within 3 minutes, in 38 women (31.7%) bleeding was stopped between 3-4 minutes and in 22 women (18.3%) bleeding was stopped >4 minutes. In 75 (62.5%) women negative pressure was applied only once, in 20 (16.7%) was applied two times and 25 women (20.8%) negative pressure was applied three times to stop bleeding. Blood collected in bottle after SR Cannula Application ranged from 100-150 ml.
Conclusions: Vacuum suction cannulas should be made part and parcel of normal delivery tray to facilitate quick application. This simple and cost-effective technique takes very little time to organize and can stop bleeding within 3 minutes in atonic PPH as shown in this study.

Keywords: Atonic PPH, SR suction cannula, Blood loss, Bleeding

INTRODUCTION

Postpartum hemorrhage is a major obstetrical emergency and one of the important but preventable causes of maternal morbidity and mortality. It is often sudden, frequently unpredictable and catastrophic.

Unless timely action is initiated, maternal death could occur in a short period. It is the leading cause of maternal death in developing countries and ranks third or fourth cause in the developed countries. Thus worldwide 1,27,000 die due to postpartum hemorrhage each year.[1] India current maternal mortality ratio (MMR) stands at 167 deaths per 100,000 live birth1. Postpartum hemorrhage

(PPH) is commonly defined as blood loss exceeding 500 mL following vaginal birth and 1000 mL following cesarean. Definitions vary however the diagnosis of PPH is subjective and often based on inaccurate estimates of blood loss. According to the American college of Obstetricians and Gynecologist PPH is defined cumulative blood loss >1000 mL accompanied by sign and symptoms of hypovolemia within 24 hours after the birth process regardless of route of delivery. Therefore, clinical sign and symptoms should be included in assessment of PPH (RCOG-2016). Clinical definition, which is more practical states, any amount of bleeding from or into the genital tract following birth of baby up to the end of the puerperium, which adversely affects the general condition of the patient evidenced by rise in pulse rate and falling blood pressure.[2] Estimates of blood loss at delivery are notoriously inaccurate, with significant underreporting being the rule. Limited instruction on estimating blood loss has been shown to improve the accuracy of such estimates.[2] Also, a decline in hematocrit levels of 10% has been used to define postpartum hemorrhage, but determinations of hemoglobin or hematocrit concentrations may not reflect the current hematologic status additional important secondary sequelae from hemorrhage exist and include adult respiratory distress syndrome, disseminated intravascular coagulation, acute renal failure, loss of fertility and pituitary necrosis.[3]

PPH is often classified as primary and secondary PPH based on post-partum duration. Primary or early PPH occurring within 24 hours of birth. Secondary or late PPH occurring more than 24 hours post-birth to up to 12 weeks of postpartum. Common cause of PPH are four Ts'; tone (atonicity), tissue (retained bits, blood clots), trauma (genital tract injury) and thrombin (coagulopathy). In addition, even though some risk factors like obstructed prolonged labor, accidental hemorrhage, pregnancy induced hypertension, polyhydramnios and big babies are known to cause atonic PPH.[4]

Globally, as per the World Health Organization (WHO) estimate, the maternal mortality rate (MMR) fell nearly by 44% over the past 25 years. The MMR is not coming down in low resource countries. In India, postpartum hemorrhage (PPH) is the leading cause of death (28%). About 50% of these women died due to atonic PPH.[5]

The only management strategy even today is "watchful expectancy" and act immediately that the usually quoted first 1or 2 hours as "Golden hours'' when the problem develops. Immediate measures are "Call for extra help'' Simpler techniques like uterine massage, uterotonics drugs, and uterine packing and balloon tamponade can be practiced in low resource settings.

The rapidity with which some women slip into coagulation failure and multi organ dysfunction syndrome from hemorrhagic shock is alarming. Because of these complex reasons the maternal mortality is not coming down in low resource countries. Hence, we need for a simpler and easier technique which can stop bleeding, or at least stop bleeding temporarily to buy some time to tide over the crisis especially in low resources setting. In low resource settings unpredictable sudden massive bleeding makes it difficult to organize competent manpower, compatible blood, and transport to higher medical centers. Hence, the present study brings into focus the invention of new technique suction cannula for atonic PPH management. One Indian study reported the concept of vacuum suction of uterine cavity to control atonic PPH. They reported the cessation of atonic bleeding within 4min after initiation of negative pressures. Simple technique of SR PPH suction cannula in these women can prevent catastrophic atonic PPH, maternal death and bring down MMR in low resource setting.[6]

In this study SR vacuum cannula will be applied to create negative pressure inside the uterine cavity with a specially designed uterine cannula, which is a simple, safe and cost-effective technique.

Aims and objectives

To analyse the incidence of atonic PPH. To analyse the effectiveness of suction cannula in management of atonic PPH after failure of medical management over tamponade. To analyse the maternal outcome after suction technique.

METHODS

This observational study was conducted in Department of Obstetrics and Gynecology, RNT Medical College and Panna Dhay Rajkiya Mahila Chikitsalaya, Udaipur, Rajasthan. Patients requiring PPH management admitted to the obstetrics ward between August 2019 – December 2020; fulfilling all inclusion criteria were included.

The uterine vacuum retraction system consists of:

SR Suction cannula to control PPH after vaginal delivery: Two sizes of vaginal cannula are available one is 25 cm long with diameter 25 mm and another is 23 cm long with diameter 25 mm.

SR suction cannula for atonic PPH at caesarean delivery for non dilated cervix 20 cm long with 12 mm diameter, for dilated cervix 14cm long with 18 mm diameter.

High vacuum suction machine or vacuum suction pump which can produce negative pressure up to 650 mmHg within 1 minute.

In case of vaginal delivery if atonic bleeding does not stop by all routine medical measures, SR suction cannula or bakri balloon (temponade) was applied in lithotomy position, and the bladder was catheterized. Blood clots were removed from uterine cavity by bimanual compression. Under good source of light with wide blade vaginal speculum application, the anterior lip of cervix is grasped with sponge holding forceps, and the uterine end

of cannula is inserted into the uterine cavity up to the level of fundus. The outer end of cannula is connected to the suction machine through tubing. The left palm supports the fundus per abdomen, right hand finger grasps the outer end of cannula and pushes it gently up to the fundus keeping the cannula in this position (to prevent slipping out). Negative pressure of 650 mmHg is created by suction machine and maintained for 10 minutes. Then the suction machine was put off. This makes the cannula to get fixed in this position due to suctioning of soft cervical tissues into the perforations on the cervical portion of cannula. Negative pressure is applied for 10 minutes per hour for the period of 3 hrs.

After this, the negative pressure is created whenever there is a recurrence of bleeding, twenty-unit oxytocin in 500 cc ringer lactate iv drip is used whenever needed. The cannula is kept in position as long as the threat of recurrence of bleeding is expected, or even up to 24 hrs.

Cannula removal after the procedure, when we try to pull the cannula, it did not came out easily. This is because of the formation of temporary adhesions due to sucking of soft cervical tissue into perforations of the cervical portion of the cannula. Cannula is removed easily after gentle separation of these adhesions by finger manipulation.

In case of caesarean section one end of the suction tube was connected to the cannula the other end is inserted through the uterine wound and brought outside the vagina. If cervix was not well dilated, the small size cannula was used. The outer end of suction tube was connected to the suction machine. After keeping the cannula in proper position for 10 mins, and after keeping the cut edges of the wound close together, negative pressure was applied. Uterine wound was closed when negative suction pressure was working.

Inclusion criteria

The study included all the patients with - atonic PPH who failed to respond to uterotonic drugs.

Exclusion criteria

Traumatic PPH. Previous cesareans with risk of scar dehiscence. Morbidly adherent Placenta. Congenital coagulation disorder. HELLP syndrome.

Plan of action

Case was evaluated for exclusion criteria were taken after written informed consent. Detailed history (including menstrual history, obstetrical history, past and family history) was taken.

Statistical analysis

Data was entered in MS Excel software version 17 and analysed using statistical for social sciences (SPSS). Descriptive format & diagrammatic presentation was done using bar diagram or pia chart as required. For descriptive analysis we used mean, standard deviation, ratio and proportion with percentage. The quantitative data, if required was analysed using independent student's t test, $p<0.05$ was be considered as level of statistical significance.

RESULTS

Majority of patients (41.7%) were between 21-25 year of age.

Table 1: Distributions of study population according to age.

Age (years)	No. of patients	%
<20	20	16.7
21-25	50	41.7
26-30	40	33.3
31-35	13	10.8
>35	5	4.2
Total	120	100.00%

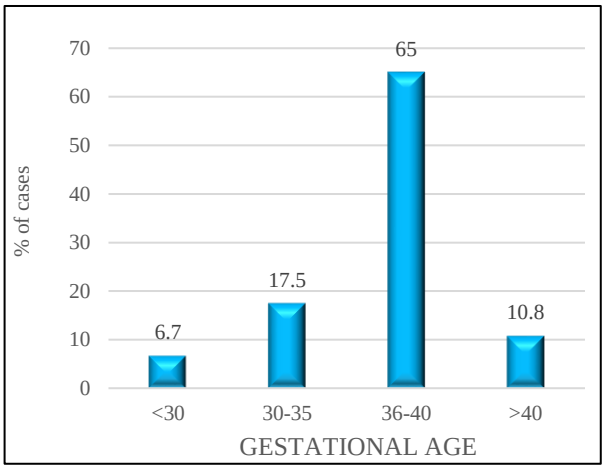

Figure 1: Distributions of study according to gestational age.

Majority of patients reported were in the 36-38 weeks of gestational age.

Table 2: Mode of delivery.

Mode of delivery	No. of patients	%
Vaginal	74	61.7
Operative vaginal delivery	25	20.8
Caesarean section	21	17.5
Total	120	100.00

Maximum deliveries were vaginal deliveries (61.7%) followed by operative vaginal delivery (20.8%) and caesarean section (17.5%).

In majority of the patients bleeding was stopped within three minutes. 60 women (50%) bleeding was stopped within 3 minutes, in 38 women (31.7%) bleeding was stopped between 3-4 minutes and in 22 women (18.3%) bleeding was stopped >4 minutes.

Table 3: Distribution of study according to time taken to stop bleeding.

Time Taken	No. of patients	%
<3 Min	60	50.0
3-4 Min	38	31.7
>4 Min	22	18.3
Total	120	100.00

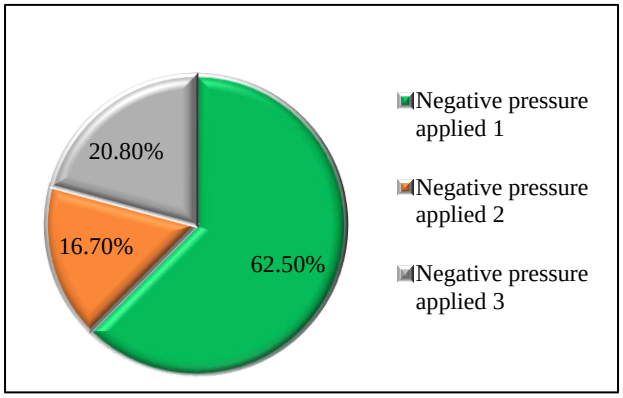

Figure 2: Distributions of study according to number of times of negative pressure applied.

Table 4: Distributions of study according to amount of blood collected in bottle.

Amount of blood collected in bottle after SR cannula application	No. of patients	%
<100 ml	36	30.0%
101-150 ml	60	50.0%
151-200 ml	13	10.8%
201-300 ml	3	2.5%
>300 ml	8	6.7%
Total	120	100.00%

In 75 (62.5%) women negative pressure was applied only once, in 20 (16.7%) women negative pressure was applied two times and 25 women (20.8%) negative pressure was applied three times to stop bleeding.

Blood collected in bottle after SR Cannula Application ranged from 100-150 ml, 36 women (30%) <100 ml blood was collected in bottle.

19 women (15.83%) were transfused one unit packed cell volume, 8 women (6.67%) were transfused two unit packed cell volume, two women (1.67%) were transfused three unit PCV and 10 women (8.33%) women transfused more the three unit packed cell volume. 81 (67.5%) women had no blood transfusion.

Table 5: Distribution of study according to need of blood and blood products transfusion.

No. of unit transfused	No. of patients	%
One	19	15.83
Two	8	6.67
Three	2	1.67
>Three unit	10	8.33
No transfusion	81	67.50
Total	120	100

Table 6: Outcome.

Outcome		No. of patients	%
Survived		115	95.83
Died	Failure of SR cannula	0	0
	Other causes	5	4.17
Total		120	100.00

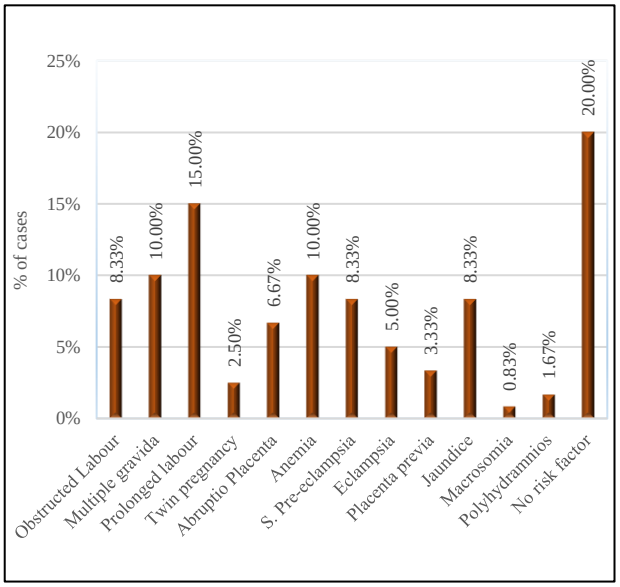

Figure 3: Distribution of study population according to risk factor.

24 (20%) cases had no risk factor, followed by 18 (15%) prolonged labour, 12 (10%) cases of multiple gravida and anemia each, 10 (8.33%) cases of obstructed labour, severe pre-eclampsia and jaundice respectively, 8 (6.67%) cases of abruptio placenta, 6 (5%) of eclampsia, 4 (3.33%) of placenta previa, 3 (2.50%) of twin pregnancy, 2 (1.67%) cases of polyhydramnios, 1 (0.83%) cases of macrosomia.

Majority of cases 115 (95.83%) survived following use of SR cannula and 5 (4.17%) women died due to various reasons. Out of these, two cases of atonic PPH also had

severe jaundice and had coagulation defect. One patient had eclampsia and died due to hepatic encephalopathy. Two cases of severe anemia with pregnancy, this was leading indirect cause of atonic PPH and maternal death. These patients had Hemoglobin less than 5 gm% and could not stood the stress of labour and minimal amount of bleeding. These two cases had congestive cardiac failure and brought in moribund condition at the time of admission and died within 24 hours of admission.

DISCUSSION

In our study majority of patients were between 21-25 yr of age. 20 women (16.7%) belonged to <20 years age group,50 women (41.7%) belonged to 21-25 years age group, 40 women (33.3%) belonged to 26-30 years age group, 13 women (10.8%) belonged to 31-35 years age group, only five women (4.2%) belonged to >35 years age group.

Samartha et al in their study took patients between 20-33 years of age group. Maximum number of patients were in the age group of 26-30 years of age, which were similar to our study.[6]

In present study according to gestational age, majority of patients were between 36-38 weeks of gestational age. 8 women (6.7%) belonged to <30 weeks of gestational age, 21 women (17.5%) belonged to 30-35 weeks of gestational age, 78 women (65%) belonged to 36-40 weeks of gestational age and 13 women (10.8%) belonged to >40 weeks of gestational age.

Samartha et al6 in their study had maximum number of patients with gestational age >38 weeks, which were similar to our findings.

Majority of the patients were delivered by vaginal route. 74 women (61.7%) were delivered by vaginal route, 25 women (20.8%) were delivered by operative vaginal delivery and 21 women (17.5%) were delivered by cesarean section.

Similar findings were reported by Samartha et al.[6] Maximum number of patients (59%) with vaginal delivery, few had emergency caesarean section.

In majority of the patients bleeding was stopped within three minutes. 60 women (50%) bleeding was stopped within 3 minutes, in 38 women (31.7%) bleeding was stopped between 3-4 minutes and in 22 women (18.3%) bleeding was stopped >4 minutes.

In case series of Prophylactic SR PPH Suction Cannula application for high-risk women for atonic PPH by Samartha et al complete cessation of bleeding which was associated with firm contraction and retraction of uterus was observed in all women within 2-3 minutes after initiation of negative pressure in both C-sections and vaginal deliveries in 22 women is comparable to our study where majority of patients were stopped bleeding within 3 minutes.[6]

In present study on 75 (62.5%) women negative pressure was applied only once, in 20 (16.7%) women negative pressure was applied two times and 25 women (20.8%) negative pressure was applied three times to stop bleeding.

Samartha et al reported maximum number of patients (68%) negative pressure was applied once, two times in 27.27% and three times in 4.5% patients.[6]

Blood collected in bottle after SR Cannula Application ranged from 100-150 ml, 36 women (30%) <100 ml blood was collected in bottle, of 60 women (50%) blood collected in bottle ranged from 101-150 ml, of 13 women (10.8%) blood collected in bottle ranged from 151-200 ml, 3 women (2.5%) blood collected in bottle ranged from 201-300 ml, 8 women (6.7%) blood collected in bottle more the 300 ml. In case series of prophylactic SR PPH suction cannula application for high risk women for atonic PPH by Samartha et al.[6] The amount of blood collected in suction bottle ranged from 50-200 ml. this amount of blood collected is comparable to our study in which 60% of patients were collected 101-150 ml of blood.

In 19 women (15.83%) one unit packed cell volume was transfused, two unit packed cell volume was transfused in 8 women (6.67%), three unit PCV was transfused in two women (1.67%) and in 10 (8.33%) women more than three unit packed cell volume was transfused. 81 (67.5%) women had no blood transfusion.

24 (20%) cases had no risk factor, followed by 18 (15%) prolonged labour, 12 (10%) cases of multiple gravida and anemia each, 10 (8.33%) cases of obstructed labour, severe pre-eclampsia and jaundice respectively, 8 (6.67%) cases of abruptio placenta, 6 (5%) of eclampsia, 4 (3.33%) of placenta previa, 3 (2.50%) of twin pregnancy, 2 (1.67%) cases of polyhydramnios, 1 (0.83%) cases of macrosomia.

Samartha et al reported maximum number of patients had PIH as risk factor followed by anemia, abruptio placenta, twin pregnancy, severe eclampsia and hydramnios.[6]

Majority of cases 115 (95.83%) survived following use of SR cannula and 5 (4.17%) women died due to various reasons. Out of these, two cases of atonic PPH also had severe jaundice and had coagulation defect. One patient had eclampsia and died due to hepatic encephalopathy. Two cases of severe anemia with pregnancy, this was leading indirect cause of atonic PPH and maternal death. These patients had hemoglobin less than 5 gm% and could not stood the stress of labour and minimal amount of bleeding. These two cases had congestive cardiac failure and brought in moribund condition at the time of admission and died within 24 hours of admission.

Atonic postpartum hemorrhage is the leading cause for maternal death all over the world, especially in low

resource countries.[7] It is the rapid exsanguinations of the woman due to uterine atony. In low resource settings make it is difficult to organize competent manpower, compatible blood products availability and transport to higher medical center. As the techniques available to control bleeding in low resource settings are inadequate, majority of maternal deaths still continue to occur in theses settings.

In present study, vacuum retraction stopped bleeding in 120 women within 3-4 minutes after the initiation of negative pressure inside the uterine cavity. Currently the balloon tamponade is being widely advocated as an affordable alternative to blood loss management in severe atonic postpartum hemorrhage refractory to uterotonic therapy.[8]

In this technique the uterine cavity is filled with condom balloon or Bakri balloon and maintained with hydrostatic pressure. This water filled balloon expands the uterine cavity and applies constant pressure (more than the systolic blood pressure) on sinusoids and stops bleeding.[9] The drawbacks with this technique include the mechanism of action is against the natural physiological mechanism of contraction and retraction. It requires some time to organize this balloon tamponade system and to perform tamponade test. In a case of profuse bleeding due to adherent cotyledons, delay in organizing tamponade system may result in a catastrophe. Sometimes the balloon may get expelled when the tone in the uterine wall increases if the vagina is not effectively packed with gauge.[9]

Effective cessation of atonic bleeding by the negative pressure created inside the uterine cavity results in physical constriction of uterus and assists the natural physiological process of contraction and retraction. The soft cervical tissues around the cervical portion of the uterine cannula get sucked into the perforations resulting in closed uterine cavity. Further application of suction results in quick development of negative pressure inside the uterine cavity resulting in uniform constriction of uterus. This assists the natural physiological process of contraction and retraction and results in cessation of both arterial bleeding and venous oozing. In this technique blood collected in the uterine cavity get sucked and collected into the suction bottle and helps to measure the blood loss correctly. As this procedure needs little time and minimal skills, this procedure can be done in labor room settings as a first aid measure. As this is a simple technique, even maternity nurses can be trained, and the bleeding can be stopped without any delay. This life saving technique avoids laparotomy and other complex procedures to stop atonic bleeding and helps to save the mother and her fertility function in low resource settings.

In this study, the novel technique of suction using SR cannula especially in atonic PPH, the blood collected in the suction bottle ranged from 50 to 300 ml. In women, there was recurrence of bleeding after first application of negative pressure, which required repeated applications. 5 women who died had massive PPH occurred due to various reasons, couldn't saved in spite having controlled bleeding after applying SR vacuum cannula.

With modifications in the sizes and shapes of SR cannula, we could apply cannula in both cases of caesarean section and vaginal delivery. We should always Prophylactic application of suction cannula in high rick women with gross anemia complicating pregnancy is life saving. As these women are already in a state of cardiovascular decompensation even minimal blood loss during third stage may prove fatal. As the costs, resources and expertise involved are minimal, this technique can be used liberally in especially in low resource settings.

CONCLUSION

Role of SR Vaccum cannula as novel technique in high risk women for atonic PPH averts catastrophic bleeding. Vacuum suction cannulas should be made part and parcel of normal delivery tray to facilitate quick application. This simple and cost effective technique, takes very little time to organize and can stop bleeding within 3 minutes in atonic PPH as shown in this study. It requires minimal training, conserves the uterus, and is technically less challenging and associated with less blood loss than hysterectomy. This lifesaving technique is useful in all settings especially in low resource settings. Its utilization in cases of inherited coagulopathies of pregnancy and DIC has to be further explored. The long term application of SR vacuum suction cannula in atonic PPH management, it can lead to infection and ischemia on cervix and uterus due to vacuum effect. These complication of SR vacuum cannula in future can be further explored.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Damor P, Maheshwari S, Singh S. Role of SR vacuum cannula as novel technique for atonic PPH management study at Pannadhay Rajkiya Mahila Chikitsalaya and RNT Medical College, Udaipur. Int J Reprod Contracept Obstet Gynecol 2021;10:4150-6.