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# The Efficacy of the B-Lynch Procedure in Reducing Labor-Related Mortality and Morbidity in Low-Income Health Facilities in Low Setting Health Facilities

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**Abstract**

**Purpose:** Postpartum hemorrhage is a preventable cause of maternal death, yet it is rising in underdeveloped nations with low health resources. So, this study looked into whether B-Lynch and modified B-Lynch uterine compression sutures could stop major postpartum bleeding caused by uterine atonia in EL-Obeid, Sudan.

**Methodology:** This is a descriptive longitudinal study undertaken at the Obstetrics and Gynecology hospitals in El-Obeid and Alfayhaa, located in North Kordofan State, Sudan. The study took place from January 2019 to December 2023. This study has registered a total of 218 individuals for participation.

**Findings:** Using uterine compression sutures resulted in a remarkably low rate of problems, with only 2.3% of individuals experiencing adverse effects. About 71.5% of the study population did not have a blood transfusion. Only 0.9% of patients undergo peripartum hysterectomy. Registrars performed surgery on around 18.8% of the patients. The majority, approximately 45.4% of the patients, underwent elective cesarean sections for delivery. The majority of the cases, amounting to 66.5%, occurred in metropolitan areas. Individuals at the primary level of education reported the majority of the instances, accounting for 36.6%. The majority of events occurred within the age range of 21 to 25 years, accounting for 24.3% of the total.

**Unique contribution to theory, practice and policy:** When uterotonic medications fail, uterine compression sutures are a safe, effective, and simple conservative surgical method for atonic postpartum hemorrhage. Well-trained doctors, including early careerists, can execute these simple procedures.

**Keywords:** *B-Lynch, Modified B-Lynch, EL-Obeid, Sudan, Atonia*.

## Introduction

Postpartum hemorrhage (PPH) refers to excessive bleeding from the birth canal, amounting to 500 mL or more, within 24 hours after giving birth. It is the leading cause of maternal mortality and significant illness worldwide [1]. It is among the most avoidable severe outcomes in obstetrics. According to the World Health Organization, over 78,000 women die each year due to postpartum hemorrhage. The condition leads to hypovolemic shock, disseminated intravascular coagulation, and other life-threatening outcomes [2]. Uterine atonia is responsible for 80% of cases of postpartum hemorrhage. Other contributing factors include bleeding disorders, placenta previa, morbidly adherent placenta, multiple pregnancies, grand multiparity, uterine fibroids, aided vaginal delivery, and personal history [3]. Treating atonic postpartum hemorrhage poses significant challenges. The B-LLynch compression suture is a surgical procedure that effectively manages atonic postpartum hemorrhage when uterotonic medicines have been unsuccessful [4]. The use of Lynch sutures reduces the negative outcomes of postpartum hemorrhage, such as the need for blood transfusion, admission to the intensive care unit, puerperal infection, and cesarean hysterectomy [5]. When there is a high likelihood of significant bleeding following a cesarean section, the use of a B-Lynch suture can effectively decrease postpartum hemorrhage [6]. Therefore, it is advisable to do this procedure early in order to prevent complications. Complications of B Lynch suture include uterine wall necrosis [7], Sherman's syndrome, secondary amenorrhea [8], and cesarean hysterectomy [9].

Despite our thorough investigation, there is a total lack of data examining the use of uterine compression sutures as conservative surgical interventions for atonic postpartum hemorrhage in Sudan. The objective of this study was to evaluate the efficacy of these sutures in EL-Obeid town, as postpartum hemorrhage is a leading cause of maternal mortality in underdeveloped countries with limited healthcare resources.

## Materials and Methods

This is a descriptive longitudinal study that took place between January 2019 and December 2023 at the El-Obeid Obstetrics and Gynecology Hospital and the Alfayhaa Private Obstetrics and Gynecology Hospital in North Kordofan State, Sudan. This study enrolled around 218 participants. The patients underwent either an elective caesarean section, an emergency caesarean section, or vaginal delivery, with a five-year follow-up period. The sample included all individuals who had atonic postpartum hemorrhage or were at risk of developing it and had undergone B-Lynch suture. We excluded patients with other types of postpartum hemorrhage.

**Statistician Analysis:** We first compiled the data in a datasheet and then input it into a computer program known as the Statistical Package for the Social Sciences (SPSS) (Version 24, Chicago, USA). We performed calculations to determine frequencies, percentages, and cross-tabulation.

**Informed consent: B**efore the interview, every participant was required to sign a written ethical consent form.

**Ethical consideration**: Approval was obtained from El-Obeid Obstetrics and Gynecology Hospital and the Alfayhaa Private Obstetrics and Gynecology Hospital in North Kordofan State, Sudan.

**Ethical Approval:** The Human Research Ethics Committee (HREC) at the Prof. Medical Research Center (PMRCC) approved the protocol for this study.

**Results**

This study examined 218 women aged 15 to 45 who had undergone B-Lynch and modified B-Lynch compression sutures for atonic postpartum hemorrhage, with an average age of 28 years. Of the 218 participants, 145/218 (66.5%) were from urban locations, with the remainder 73/218 (33.5%) from rural areas. The majority of rural participants were between the ages of 21 and 25 (27/73, 36.9%), whereas the majority of urban patients were between the ages of 26 and 30 (34/145, 23.4%), as shown in Table 1 and Figure 1.
The majority of the donors were elementary school students, followed by secondary school students, university students, illiterates, and postgraduate students, who accounted for 80/218 (36.6%), 64/218 (29.3%), 34/218 (15.5%), 32/218 (14.6%), and 8/218 (3.6%), respectively. The majority of rural residence groups (32/73, 43.8%) had primary education, whereas the majority of urban residence groups (48/145, 33.1%) had secondary education, as shown in Table 1 and Figure 1.

**Table 1. Shows the Distribution of the Study Population Based on Demographic Characteristics.**

| Variable | Rural | Urban | Total |
|---|---|---|---|
| Education | | | |
| Illiterate | 17 | 15 | 32 |
| Primary | 32 | 48 | 80 |
| Secondary | 16 | 48 | 64 |
| University graduate | 8 | 26 | 34 |
| Postgraduate | 0 | 8 | 8 |
| Total | 73 | 145 | 218 |
| Age Group | | | |
| 15 - 20 years | 11 | 24 | 35 |
| 21 - 25 | 27 | 26 | 53 |
| 26- 30 | 8 | 34 | 42 |
| 31 - 35 | 11 | 30 | 41 |
| ≥36 | 16 | 31 | 47 |
| Total | 73 | 145 | 218 |

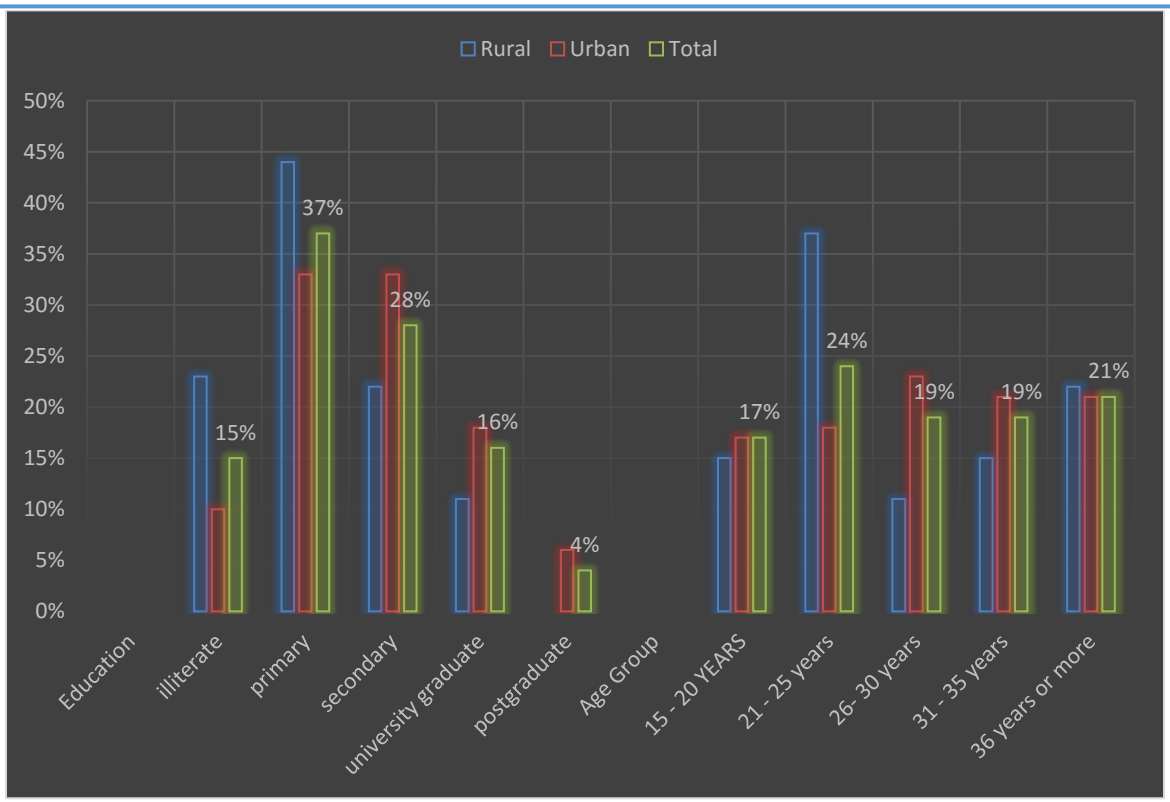


**Figure 1. Description of the study population according to demographic characteristics.**

Table 2 and Figure 2 explain the study participants' operations, blood transfusions, and complications. The bulk of the patients, 172/218 (78.8%), underwent the B-Lynch operation, whereas just 46/218 (21.1%) received the modified B-Lynch (see image 1). 156/218 (71.5%) did not receive a blood transfusion, while only 28/218 (12.8%) and 34/218 (15.5%) received 2-4 and >4 units, respectively. The majority of the study population (213/218, 97.7%) reported no complications; however, only 2/218 (0.9%), 1/218 (0.4%), and 1/218 (0.4%) experienced hysterectomy, infection, secondary amenorrhea, and endometrial adhesion formation, respectively.

**Table 2. Distribution of Study Participants by Type Of Procedure, Blood Transfusion, and Complications**.

| Variable | B-Lynch | Modified B-Lynch | Total |
|---|---|---|---|
| Number of blood units transfused | | | |
| zero | 123 | 33 | 156 |
| 2 - 4 UNITS | 22 | 6 | 28 |
| > 4 UNITS | 27 | 7 | 34 |
| Total | 172 | 46 | 218 |
| Complications | | | |
| Hysterectomy | 0 | 2 | 2 |
| Infection | 1 | 0 | 1 |
| Secondary amenorrhea | 1 | 0 | 1 |
| Endometrial adhesions | 1 | 0 | 1 |
| no complications | 169 | 44 | 213 |
| Total | 172 | 46 | 218 |

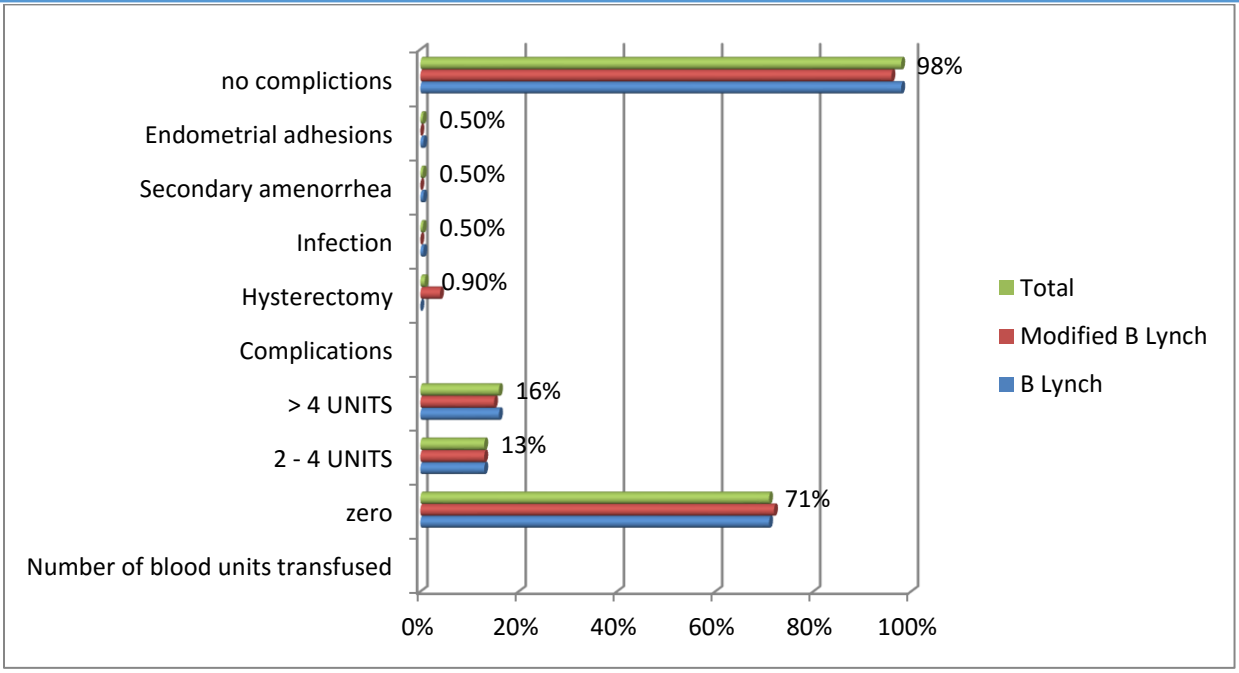


Figure2. Description of study participants by type of procedure, blood transfusion and complications.

**Table 3. Distribution of Study Population According to Mode of Delivery, Caliber of Doctor Who Performed the Procedure, and the Complications.**

| Variable | Vaginal delivery | Elective caesarean section | Emergency caesarean section | Total |
|---|---|---|---|---|
| Caliber of doctor who performed the procedure | | | | |
| consultant | 23 | 43 | 30 | 96 |
| specialist | 12 | 40 | 29 | 81 |
| registrar | 10 | 16 | 15 | 41 |
| Total | 45 | 99 | 74 | 218 |
| Complications | | | | |
| Hysterectomy | 2 | 0 | 0 | 2 |
| Infection | 0 | 0 | 1 | 1 |
| Secondary amenorrhea | 0 | 0 | 1 | 1 |
| Endometrial adhesions | 0 | 0 | 1 | 1 |
| no complications | 43 | 99 | 71 | 213 |
| Total | 45 | 99 | 74 | 218 |

Table 3 and Figure 3 describe the study population based on the mode of delivery, the doctor who performed the procedure, and the problems. Elective cesarean sections, emergency cesarean sections, and vaginal deliveries accounted for 99/218 (45.4%), 74/218 (33.9%), and 45/218 (20.6%) of the contributors, respectively. Consultants performed the majority of the procedures, with specialists and registrars following closely behind at 96/218 (44%), 81/218 (37.1), and 41/218 (18.8%), respectively. Hysterectomy was a complication in 2/45 (4.4%) of patients who delivered vaginally, whereas infection, secondary amenorrhea, and endometrial adhesion formation were complications in only 1/74 (1.3%) of patients who delivered by emergency cesarean section, with

each complication occurring equally. There are no problems among patients who delivered via elective cesarean section.

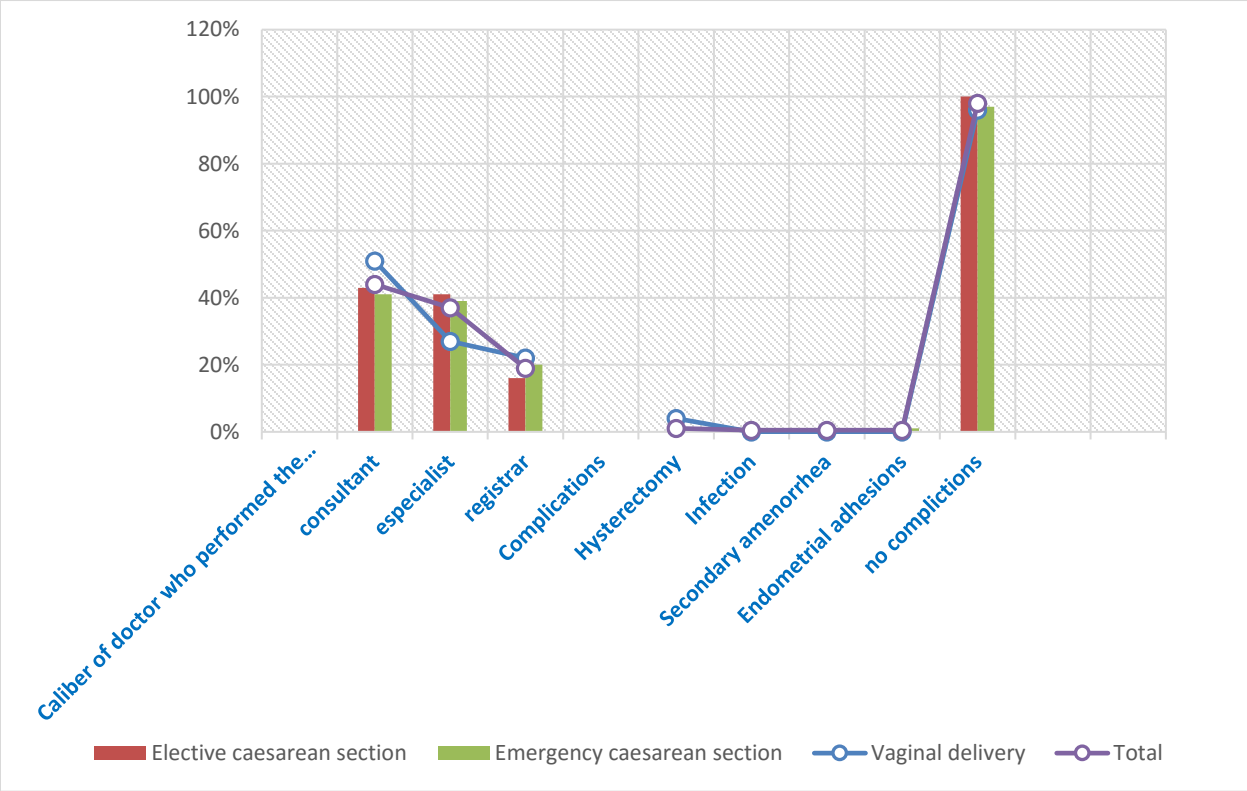


Figure 3. Description of study population according to mode of delivery, caliber of doctor who performed the procedure, and the complications.

**Table 4. Distribution of Study Population According to Type of Procedure Performed and Demographic Characteristics.**

| Variable | B Lynch | Modified B Lynch | Total |
|---|---|---|---|
| Parity | | | |
| primigravida | 28 | 9 | 37 |
| multipara | 87 | 19 | 106 |
| grandmultipara | 57 | 18 | 75 |
| Total | 172 | 46 | 218 |
| Residence | | | |
| Rural | 58 | 15 | 73 |
| urban | 114 | 31 | 145 |
| Total | 172 | 46 | 218 |
| Age Group | | | |
| 15 - 20 YEARS | 26 | 9 | 35 |
| 21 - 25 years | 41 | 12 | 53 |
| 26- 30 years | 38 | 4 | 42 |
| 31 - 35 years | 34 | 7 | 41 |
| ≥36 years | 33 | 14 | 47 |
| Total | 172 | 46 | 218 |
| Education | | | |
| illiterate | 23 | 9 | 32 |
| primary | 64 | 16 | 80 |
| secondary | 52 | 12 | 64 |
| university graduate | 29 | 5 | 34 |
| postgraduate | 4 | 4 | 8 |
| Total | 172 | 46 | 218 |

The bulk of the research subjects were multipara (106/218, 48.6%), followed by grandmultipara (75/2018, 34.4%), and primigravidae (37/218, 16.9%). The 21–24 age group performed B-Lynch sutures most frequently, while the 31–35 age group performed modified B-Lynch sutures more frequently, accounting for 41/172 (23.8%) and 14/46 (30.4%), respectively. This study revealed that patients in elementary school primarily used B-Lynch and modified B-Lynch, accounting for 64/172 (37.2%) and 16/46 (34.7%), respectively, based on their education level.

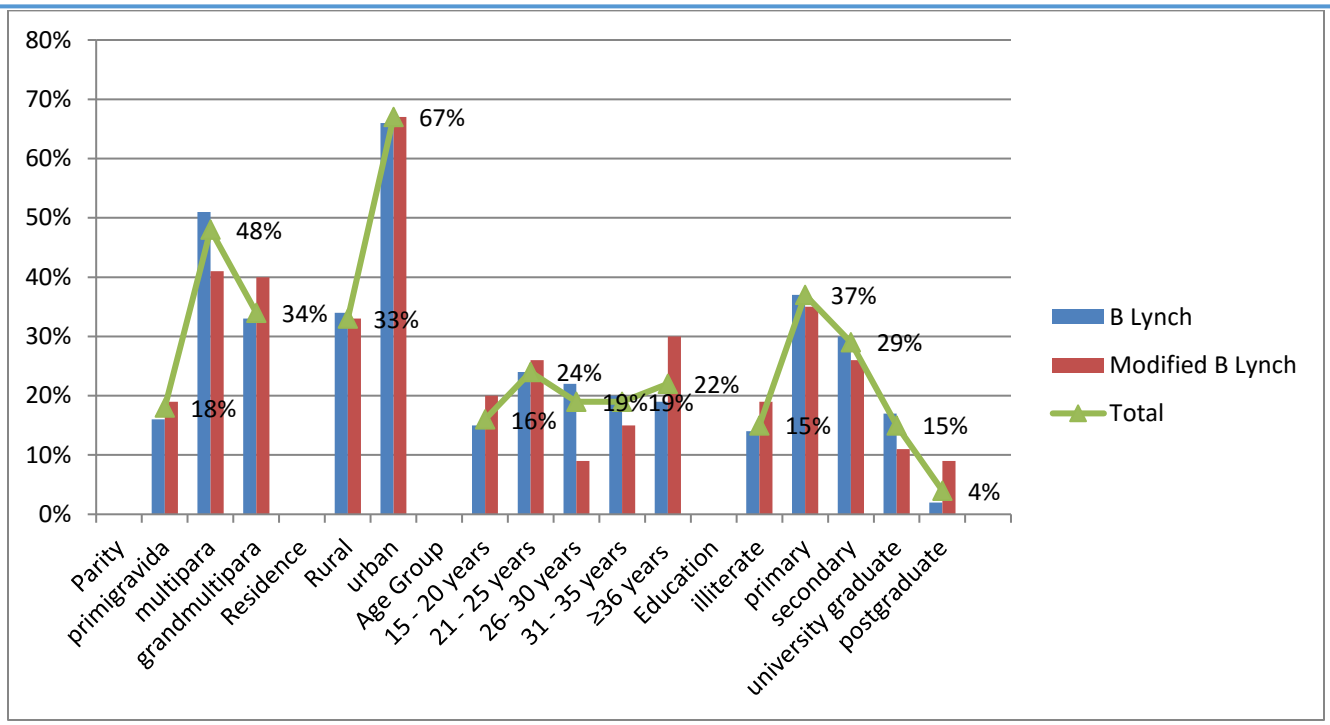


Figure 4. Description of study population according to type of procedure performed and demographic characteristics.

**Discussion**

Particularly in impoverished nations, postpartum hemorrhage is associated with elevated rates of maternal morbidity and mortality. In Sudan, the lack of adequate healthcare resources, including blood bank services and well-equipped hospitals and operating rooms, due to budgetary constraints has resulted in a higher mortality rate among patients suffering from postpartum hemorrhage. The goal of this study was to find out how well B-Lynch and modified B-Lynch surgeries can stop and treat postpartum bleeding caused by uterine atony after medical treatment with uterotonic drugs failed.

The current study's findings indicate that both B-Lynch and modified B-Lynch compression sutures are highly effective and safe. The majority of patients experienced successful outcomes, with only two patients requiring caesarean hysterectomy. Additionally, only one patient experienced complications, including infection, endometrial adhesion formation, and secondary amenorrhea. The majority of patients at risk of developing atonic postpartum hemorrhage were able to avoid blood transfusion. Instead, they applied sutures as soon as they noticed uterine atonia. In a related study, Kuwabara et al. discovered that the B-Lynch suture was effective and safe in situations where there was a suspicion of uterine atonia and subsequent postpartum hemorrhage. The study also found that using the suture earlier resulted in lower blood transfusion rates [6]. Our study also found no instances of maternal death caused by postpartum hemorrhage. We can attribute this to the early implementation of the B-Lynch suture, which significantly minimizes the

occurrence of severe postpartum hemorrhage. A study in a nearby country, Ethiopia, described a contrasting scenario where postpartum hemorrhage caused a high incidence of maternal mortality. Interestingly, this context did not utilize the B-Lynch suture technique. Thanks to our hospitals' continuous training, young doctors, registrars, and specialists have become skilled in performing B-Lynch and modified B-Lynch sutures. These young doctors successfully treated many cases of severe bleeding after childbirth, often being the first to respond to such emergencies. This significant improvement in our study has led to a substantial decrease in maternal complications and deaths. In contrast, a qualitative research study in Madagascar identified seven factors, including healthcare providers' underestimation of the importance of preventing and monitoring excessive bleeding after childbirth, that contribute to delays in managing postpartum hemorrhage. A multi-country cluster-randomized study in Nigeria, South Africa, and Kenya revealed that common obstacles to PPH therapy were a lack of experience in detecting postpartum hemorrhage (PPH) and a shortage of trained professionals. Our study found that the primary age group impacted by postpartum hemorrhage was individuals aged 21–24 years. However, a population-based retrospective cohort study in Victoria identified older maternal age as a risk factor for postpartum hemorrhage in their findings [13]. This is due to the prevalence of adolescent marriage in our population.

This study demonstrated that the majority of the participants resided in urban areas, where they had convenient access to healthcare facilities. This finding indicates that having quick access to hospitals is a crucial factor in promptly detecting postpartum hemorrhage and subsequently intervening early to decrease maternal mortality and morbidity. Therefore, the implementation of well-equipped maternity centers, comprehensive health education, and thorough training of healthcare workers will have a direct impact on reducing maternal morbidity and mortality caused by postpartum hemorrhage.

**In conclusion:**

The B-Lynch and modified techniques B-Lynch uterine compression sutures are highly efficient, secure, and straightforward to execute in emergency scenarios, including atonic postpartum hemorrhage. These treatments are straightforward and conservative surgical interventions performed when the use of uterotonic medications for management has been unsuccessful. Young doctors, with sufficient training, can perform these procedures with fewer complications.

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