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# Risk factors of uterine perforation when using contraceptive intrauterine devices

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## Abstract

**Background** Intrauterine devices (IUDs) are one of the most popular methods of contraception, and uterine perforation has been presented among the most significant potential complications of IUD use. The aim of this study is to evaluate the risk factors of uterine perforation when using an IUD.

**Methods** In this retrospective study, all 164 women who have referred to Al-Zahra hospital in Tabriz- Iran to remove the retained IUD from March 2018 to March 2021, were investigated in two groups. Patients in case group underwent surgery to remove the dislocated device and management of its complications. In control group, the devices were removed using a Novak or ring forceps with or without hysteroscopy with no uterine perforation. Data were analyzed using SPSS software, and  $P < 0.05$  was considered statistically significant. P-Value was obtained for qualitative data via Fisher's exact test and Chi-Squared test and for quantitative data via Mann-Whitney U test and independent T-test.

**Results** The mean age of patients in the groups with or without uterine perforation was 30.57 and 36.78 years respectively ( $P = 0.01$ ). The frequency of two or more parities among patients with uterine perforation was higher than other patients ( $P = 0.13$ ). Ultrasound study before ( $p = 0.037$ ) and after ( $p = 0.007$ ) IUD insertion was higher among patients without uterine perforation. The less inexperience of healthcare providers ( $P = 0.013$ ) and lack of scheduled follow-up visits after the IUD insertion ( $P < 0.001$ ), are the other important factors affecting the uterine perforation. Abdominal pain was the most common complaint of uterine perforation ( $P < 0.001$ ) and laparoscopy was the most used surgery to remove the misplaced device.

**Conclusion** Uterine perforation can be effectively prevented by hiring experienced health care providers and appropriate patient selection.

**Keywords** Laparoscopy, Uterine perforation, Intrauterine devices

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## Introduction

Intrauterine devices (IUDs) are the most commonly used method of contraception all over the world. This method is highly effective, long-acting, and reversible, and even generally well tolerated by all women. IUD use has thus become more popular because of its safety and cost-effectiveness [1, 2]. In this contraceptive procedure, pregnancy is prevented by the foreign-body reaction of the IUD frame and the endometrial changes caused by the released medication. [3] In this respect, different types of IUDs are associated with the menstrual patterns, so they should be chosen based on patients' demands [4]. The avoidance of exogenous estrogen (i.e., both copper and levonorgestrel IUDs) and hormone exposure (copper IUDs), rapid reversibility, and no interference with sexual activity are other considerations when selecting IUDs as a contraceptive method. Nevertheless, IUD expulsion, pelvic inflammatory disease (PID), contraceptive failure, increased risk of ectopic pregnancy if failure occurs, uterine perforation, and misplaced IUDs are the most important complications from IUD use [5–7]. In this context, uterine perforation is one of the most frequent complications of IUD insertion. Healthcare providers (HCPs) with no experience, anatomical disorders of the uterus and the cervix, and improper timing of IUD placement are also the most notable risk factors of uterine perforation during IUD insertion [8, 9]. Uterine perforation appears in 1/1000 cases of IUD placement, and commonly take place at the time of device insertion rather than delayed migration [2]. Of course, none of the above-mentioned risk factors have a proven effect on the possibility of uterine perforation, and more research is needed to determine the actual cause of uterine perforation when using contraceptive intrauterine devices. In this regard, IUD malposition and expulsion, misinformation about the risks of pelvic infection, ectopic pregnancy, lack of training for HCPs, and eventually uterine perforation have limited the widespread use of IUDs as a safe, long-acting contraception option [6]. Against this background, this study aimed to review the risk factors for uterine perforation as the most serious complication associated with IUD placement as well as malposition and expulsion among the most common side effects of IUD use in order to re-emphasize the safe use of IUDs as a cost-effective and long-acting contraceptive method.

## Methods

This single-center, retrospective cohort study was conducted from March 2018 to March 2021 in Tabriz- Iran on women with retained IUDs; either dislocated intraperitoneal devices or lost intrauterine ones. Before this study, the permission was obtained from the Ethics Committee (IR.TBZMED.REC.1400.686) of Al-Zahra Hospital affiliated to Tabriz University of Medical Sciences, Tabriz,

Iran, to access the patient data. All members of research team signed the written informed consent, underlining the confidentiality of the patients' identity prior to access data and publishing this article. A total of 164 patients in two groups were investigated in this study. All symptomatic women who have had a problem with IUD use and have referred to Al-Zahra hospital to solve the problem were included in this study. After initial assessment and diagnosis of uterine perforation they were evaluated in two case and control groups. In the case group the uterus was perforated, and the IUD had been embedded in the abdominal cavity, and then penetrated to the adjacent organs. Most of these patients were symptomatic, and the IUDs were removed by laparoscopy or laparotomy. Of note, laparoscopy was the method of choice for dislocated device removal, and laparotomy was used in cases with severe intra-abdominal adhesions or hemodynamically unstable patients. All complications were accurately recorded. The control group consisted of the patients who had been admitted to the hospital for IUD retrieval due to the missed IUD string, broken device, myometrial penetration, IUD expiration, abdominal pain and or irregular menses. The devices were inside the uterine cavity and the IUDs were removed through hysteroscopy (4–5) or cervical dilatation using Novak forceps. The patients were discharged after the IUD removal if no specific complications occurred. However, the patients in the case group were hospitalized for a few days, and were then discharged after the situation stabilized with regard to certain complications. All patients underwent ultrasound to determine the IUD site, and in cases where the IUD was not visible in the uterine cavity, a simple abdominal radiography was taken to localize the misplaced device. Intraoperative radiographic evaluations were also used if needed. Age, parity, the interval between previous delivery and IUD placement, breastfeeding status, menstrual history after and before IUD insertion, clinical signs that caused the patient to refer to medical facilities, time intervals from IUD insertion to diagnosis of uterine perforation, perforation site and the intraperitoneal location of missed IUDs, the person who inserted the IUD (trained or not), pain severity during device insertion, whether an ultrasound was performed before and after IUD insertion, and whether the patient had follow-up visits were all the descriptive parameters, carefully evaluated and described in both study groups to determine the risk factors of uterine perforation during IUD use. The descriptive statistics, including mean, standard deviation (SD), frequency, and percentage were further employed to explore the data. The  $p$ -value < 0.05 was considered to be statistically significant in this study.  $p$ -value was obtained for qualitative data via Fisher's exact test and Chi-Squared test and for quantitative data via Mann-Whitney U test and independent T-test.

## Results

A total of 164 patients, including the candidates for IUD removal, were recruited, i.e., 49 women with uterine perforation (case group, 29.9% of total patients) with the mean age of 30.57 (SD: 6.191), and 115 women with retained IUD without uterine perforation (control group, 70.1% of total patients) with the mean age of 36.78 (SD: 8.340). The mean age of the controls was higher than that of the case one, and the difference was statistically significant based on the independent-samples t-test results ( $p$ -value=0.01). Probably it is due to mechanism of uterine perforation. Uterine perforation usually take place at the time of IUD insertion rather than delayed migration. So its clinical presentation is somehow immediate. However, it takes nearly a long time until a properly placed IUD make bothersome symptoms for the patient. Nonetheless author think it cannot interfere with the study results. Most of IUDs were copper one. Only three patients in control group have inserted levonorgestrel-releasing intrauterine system (LNG-IUS). There was no statistically significance between two groups regarding the device type ( $p$ -value=0.342).

**Table 1** Number of parities, lactation status, the interval between IUD insertion and latest delivery and also the interval between insertion time and clinical manifestation and also ultrasound studies before and after IUD insertion, in both groups

	Case (n=49) Frequency (percent)	Control (n=115) Frequency (percent)	P-value
Parity 1	1 (2%)	25(21.7%)	0.013*
2	21(42.9%)	60(52.2%)	
3	16 (32.7%)	22(19.1%)	
4	7 (14.2%)	7(6%)	
>5	4 (8.2%)	1 (0.8%)	
Breastfeeding status at the time of IUD insertion	43 (87.7%)	93 (80.9%)	0.201*
The frequency of ultrasound study before IUD insertion	0 (0%)	81 (70.4%)	0.006*
The frequency of ultrasound study after IUD insertion	0 (0%)	79 (68.7%)	0.007*
Control visit after IUD insertion	9 (18.4%)	76 (66.1%)	<0.001**
	<b>mean ± SD</b>	<b>mean ± SD</b>	
Interval between IUD insertion and clinical manifestations(month)	59.88 ± 95.4	109.82 ± 64.01	<0.001 <sup>‡</sup>
The interval of last delivery and IUD insertion (month)	15.79 ± 35.46	17.88 ± 39.39	0.750 <sup>‡</sup>

Qualitative data are shown as frequency (percent)

Quantitative data are displayed as mean ± standard deviation (SD) according to their normal distribution

$p$ -value\*: Fisher's Exact Test

\*\* : Chi-Squared test

<sup>‡</sup>: Mann-Whitney U

Table 1 illustrates a general view of parities, intervals between previous pregnancy and IUD insertion, breastfeeding status, ultrasound frequency before and after IUD insertion, and follow-up visits, and intervals between IUD insertion and clinical manifestations in both groups. Following the statistical analyses (Fisher's exact test), the number of parities in the case group were found to be higher compared to those in the control group, and the differences were statistically significant ( $p$ -value=0.013). The comparison between the types of previous delivery (that is, Cesarean section versus normal-vaginal delivery) between both groups revealed no difference with regard to the Fisher's exact test outcomes ( $p$ -value=0.866). The types of IUD (whether copper or hormonal) were also similar in both groups, with the higher frequency of copper types, based on the Fisher's exact test results ( $p$ -value=0.342). Moreover, no significant difference was observed between both groups in terms of the interval between previous delivery and IUD insertion regard to the Mann-Whitney U test ( $p$ -value=0.750). According to the Fisher's Exact Test, the breastfeeding status was analogous between the study groups, and the majority of patients in both groups were lactating mothers ( $p$ -value=0.201). Both groups were further compared in terms of ultrasound studies before and after IUD insertion. In this respect, the frequency of ultrasound evaluations before and after IUD insertion in the controls was higher than that in the case group. Considering the statistical analysis, the differences were significant based on the Fisher's exact test outcomes both before ( $p$ -value=0.037) and after ( $p$ -value=0.007) the comparisons. Moreover, based on Fisher's exact test the rate of follow-up visits among the controls was higher than that in the case group, and the difference was statistically significant ( $p$ -value<0.001). The interval between the IUD insertion and any clinical manifestations for which the patients had referred to healthcare facilities was further compared. This interval was calculated in months, and it was shorter in the case group than in the control one. The difference was also statistically significant based on the Mann-Whitney U test results ( $p$ -value<0.001).

Table 2 shows the frequency of different reasons for which the patients referred to healthcare facilities after IUD insertion. The most prevalent reason in the control group was tendency for IUD retrieval due to the missed IUD string, broken device, myometrial penetration, IUD expiration, pregnancy, abdominal pain and or irregular menses. However, abdominal pain and vaginal bleeding were reported as two most prevalent reasons of visits in the case group. The difference between the reasons expressed by both groups for their visits were statistically significant based on the Fisher's exact test results ( $p$ -value<0.001).

**Table 2** The frequency of reasons for referring to healthcare provider after IUD insertion

	Groups		P-value
	Case (n = 49) Frequency (percent)	Control (n = 115) Frequency (percent)	
Vaginal bleeding	5(10.2%)	23(20.1%)	0.094*
Abdominal pain	17(34.6%)	12(10.4%)	< 0.001*
pregnancy	10(20.4%)	5(4.3%)	0.002*
IUD string missing	4(8.1%)	56(48.7%)	< 0.001*
IUD expiration	0 (0%)	5(4.3%)	0.165*
Broken IUD	0 (0%)	1(0.9%)	< 0.001*
Myometrial penetration	2(4.0%)	6(5.2%)	0.701*
Vaginal bleeding and abdominal pain	11(22.4%)	7(6.1%)	0.004*

Qualitative data are shown as frequency (percent)

Quantitative data are displayed as mean  $\pm$  standard deviation (SD) according to their normal distribution

p-value\*: Fisher's Exact Test

**Table 3** Frequency of different anatomical sites of uterine perforation and device penetration

Anatomical site of uterus which was perforated	Frequency (percent) (n = 49)	The organ that the dislocated device was embedded	(n = 49) Frequency (percent)
Posterior wall	13(26.53%)	Anterior abdominal wall	5(10.2%)
Anterior wall	7(14.28%)	Omentum	19(38.7%)
Fundus	10(20.4%)	Ascending colon	5(10.2%)
Left lateral wall	6(12.24%)	Ilium	2(4.0%)
Right lateral wall	4(8.16%)	Appendix	3(6.1%)
Cervix	1(2.04%)	Sigmoid colon	4(8.1%)
Undetermined	8 (16.32%)	Cul-deu-sac	3(6.1%)
		Rectum	3(6.1%)
		Bladder	2(4.0%)
		Lateral pelvic wall	3(6.1%)

Qualitative data are shown as frequency (percent)

Quantitative data are displayed as mean  $\pm$  standard deviation (SD) according to their normal distribution

At the next step, the uterine perforation site and the type of surgery performed for each case were investigated (Table 3).

The posterior uterine wall was the most common site of uterine perforation and the perforated device most frequently had been enwrapped with omentum. Ascending colon, sigmoid, appendix, rectum, ilium and bladder were the other injured organs respectively (Fig. 1). Bowel injury had been taken place in nine patients. Two cases were due to perforation of ileum and the patients had the signs and symptoms of acute abdomen. Acute appendicitis was happened in one patient due to penetration of IUD into the appendix. Fistula formation between the ascending colon and appendix had also been taken place in another case. There were also three cases of sever

rectal adhesion in cases of rectal penetration of ectopic devices. Sever sigmoidal adhesion was also found in two patients. Posterior bladder wall was the injury site in cases with bladder penetration. However, there was no essential bladder injury. There was no any complication at the time of IUD extraction in none of groups.

Laparoscopy was the most frequent surgery in the case group whereas IUD removal using Novak or ring forceps with or without hysteroscopy was preferred intervention in control group. From 115 women with partial IUD penetration and without uterine perforation, 87 cases (75.6%) underwent hysteroscopic removal of misplaced device. There were no cases of Mullerian anomalies in both groups.

Laparotomy had been performed in twenty-four women. Three patients in case group had been undergone emergency laparotomy due to acute bowel injury and vital signs instability. In other eleven patient of case group, laparoscopy had been converted to laparotomy due to sever intra peritoneal adhesions and visceral damage and fistula formation (Fig. 1).

The other laparotomies had been performed in control group due to concomitant myomectomy (six patient) and management of ectopic pregnancy (four patient). The other remained patients with ectopic pregnancy had been operated laparoscopically at the time of IUD extraction.

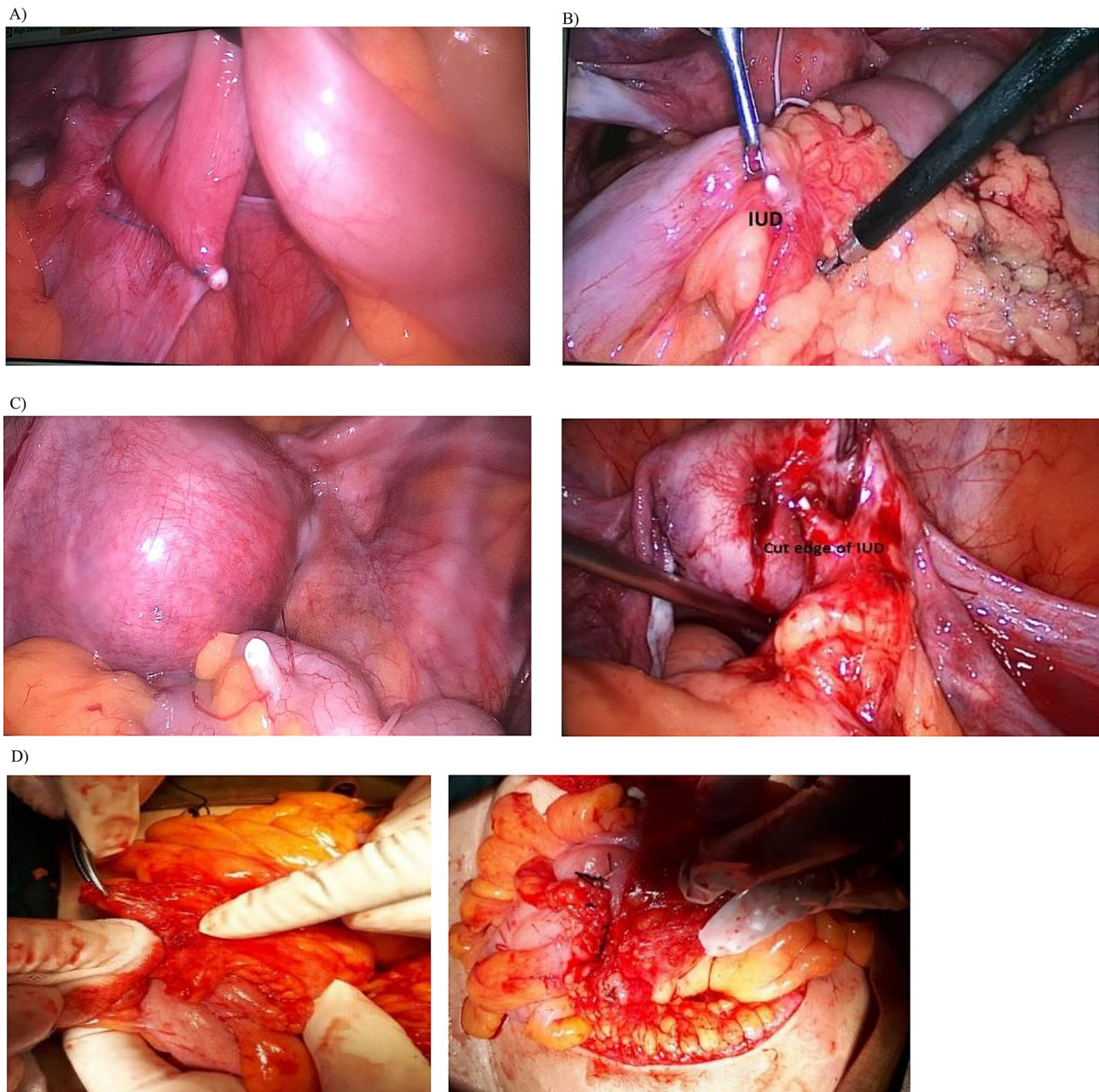
An overview of the results of pregnancies after IUD insertion is provided in Table 4. In this respect, 9 out of 26 cases of pregnancy in the presence of IUD had continued until the term, and the rest, including 17 patients, had terminated in the first trimester due to complications of pregnancy. The menstruation periods of women in both groups before and after IUD insertion were mostly regular, and the difference was not statistically significant with regard to the Fisher's exact test results.

Regarding the HCPs, most of IUDs in the case group had been inserted by inexperienced health care providers (HCPs) compared to the controls based on Fisher's Exact Test ( $p$ -value=0.013).

## Discussion

Although there are more researches on complications of IUD as a contraception method, some notable points regarding the risk factors of uterine perforation at the time of IUD placement led to fulfilling this study. Indeed, we want to summarize these risk factors and provide a solution, when it is possible, in order to safe use of IUDs as a long acting reversible contraception method.

Among the complications of intrauterine contraceptive devices, including IUD expulsion and malposition, uterine perforation, pelvic inflammatory diseases (PID) and contraceptive failure, uterine perforation seems to be a more serious complication of IUD use. It can be prevented by appropriate patient selection, device insertion



**Fig. 1** Misplaced IUDs embedded to various adjacent organs **A** Dislocated device which was embedded to the bowel. The device was removed and the bowel was repaired. **B** The string of the perforated device was located inside the abdomen and the device was enwrapped with omentum. **C** Dislocated device was penetrated to appendix. Appendectomy was performed and the device was removed. **D** The device was penetrated to anterior rectal wall. Laparoscopy was converted to laparotomy due to notable bowel damage

timing and also hiring well experienced HCPs. Although IUD expulsion and malposition rate is higher in postpartum IUD insertion (10–40%) compared with non-postpartum ones (3–10%) [10, 11] and scheduled post insertion ultrasounds are needed to diagnose the cases of IUD expulsion or misplacement, [12–14] only limited studies have reported relatively high prevalence of uterine perforation in postpartum IUD insertion [15]. None of IUDs in our study was inserted immediately or early in

postpartum period, so we cannot comment about the risk of post-partum IUD placement on uterine perforation rate or IUD expulsion. This can be one of weak points of our study related to the study design and patients including criteria.

Breastfeeding is another factor that augments the risk of uterine perforation when inserting the IUD by six times, regardless of the type of device, whether copper or hormonal. It is related to the postpartum hypo estrogenic

**Table 4** Pregnancy outcome with IUDs

Pregnancy outcome (n = 26)		Group		P-value
		Case Frequency (n = 21) (percent)	Control Frequency (n = 5) (percent)	
Curettage due to vaginal bleeding	Drainage curettage	4 (8.16%)	4 (3.48%)	0.187*
Term delivery	Term delivery + uterine perforation and IUD migration into abdominal cavity	8 (16.32%)	0 (0%)	< 0.001*
	Term delivery + intrauterine IUD	0 (0%)	1 (0.87%)	0.701*
Ectopic pregnancy	Ruptured ectopic pregnancy	9 (18.36%)	0 (0%)	< 0.001*

Qualitative data are shown as frequency (percent)

Quantitative data are displayed as mean ± standard deviation (SD) according to their normal distribution

p-value\*: Fisher's Exact Test

status and high serum prolactin level [8, 16]. Most of IUDs in this study had been inserted in the 18 months after the latest delivery, so the majority of the patients were lactating mothers. However, we found no significant difference between two groups considering breastfeeding status. Indeed, breastfeeding was an inevitable risk factor and maybe a confounding factor in our study.

The distortion of the uterine cavity and anatomical anomalies of the uterus, either congenital or acquired, are the other risk factors of uterine perforation during IUD insertion [17]. Mullerian anomalies and uterine leiomyomas are further associated with higher risks of uterine perforation when inserting an IUD, so they are relative contraindications for IUD placement [18, 19]. As the same reason, the retroverted or anteverted uterus is also connected to the high risk of uterine perforation when using an IUD as a contraceptive method, even by experienced HCPs [20, 21]. Smaller uterine cavities less than 6 cm by sounding are further related to the higher risk of IUD misplacement and dislocated devices, as well as larger cavities associated with IUD inefficacy and contraception failure [22]. Ultrasound studies before IUD placement can thus determine the structural disorders of the uterus, and prevent the unwanted complications of IUD insertion [23]. Accordingly, post-insertion ultrasound studies are useful to determine the IUD position inside the uterus as well as dislocated devices [12]. We found statistically significant differences between two groups regarding the ultrasound studies before the IUD placement in order to distinguish the distorted or unsuitable wombs considering the size and shape of uterus

(i.e. myomatous, anteverted, retroverted or congenitally abnormal womb). This can imply inappropriate patient selection for IUD insertion leading to subsequent complications. There were also statistically significant differences between two groups of this study regarding the post insertion ultrasound evaluation of newly inserted device in order to localize the newly inserted device (was it placed properly or not), indicating poor patient follow-up after the device placement.

As mentioned in previous studies health care providers either physician or midwife should be trained well about IUD insertion and experienced well on signs and symptoms of its complication [24]. Only a few HCPs had enough experience regarding IUD insertion in case group of this study, and most of them had tried this procedure for the first time. Therefore, they were not familiar with the complications of IUD insertion as well as the prevention, diagnosis and management of its complications. Such HCPs were also afraid to express the side effects to the patients, so none of the cases with excessive abdominal pain during IUD insertion had underwent post insertion ultrasound study to localize the newly inserted device [21] in this study. This had led to the delayed diagnosis of uterine perforation when the misplaced device had been embedded in the adjacent organs, and resulted in intraperitoneal adhesions and chronic abdominal complications [24]. Although mild-to-moderate pain or discomfort is usual at the time of IUD insertion, severe and intolerable or continuous abdominal pain may be a sign of uterine perforation and visceral damage by the misplaced device [25., 26] This infrequent pain can be an indication for further evaluations during IUD insertion, a fact that may be easily ignored by inexperienced HCPs [24] as has taken place in this study. These low levels of experience had additionally led to multiple IUD placements in some patients because they had never used plain abdominal radiography to localize the lost device. [27] Moreover, the inexperienced HCPs had improperly interpreted the absence of IUD strings on follow-up visits as IUD expulsion. They had even misinterpreted the invisible IUD strings and the lack of IUD in the uterine cavity on ultrasound study (when they did it) as IUD expulsion. This misinterpretations, had led to the insertion of the second, and sometimes, the third devices, with no efforts to localize the first one [24]. Although there is no evidence that women should check their IUD strings routinely or schedule tight follow-up visits [28] nevertheless, women with invisible IUD strings must perform ultrasound studies to determine their proper device placement. For women whose IUD is not visible in the uterus by ultrasound, additional imaging is further needed to diagnose the perforated intrauterine device unless they have clearly seen the disposal of the IUD. In this respect, there were also statistically significant differences between two

groups of this study regarding the follow-up visits scheduled according to HCP' preference.

Five women (3.1%) in this study (one patient 2% in case group and 4 patients 3.6% in control group) had uncontrollable abnormal uterine bleeding, leading to IUD removal. All of them had uterine leiomyomas (indicating improper patient selection), and the majority of them underwent surgical myomectomy after IUD removal. This can be one of the weak points of this study related to the type of study. (It means we studied all patients without considering the fact that was the patient selection proper or not?). Indeed, further long time prospective researches are needed to demonstrate the efficacy of patient selection on IUD use complications. As mentioned in previous studies, the distortion of the uterine cavity was one of the risk factors of IUD expulsion or concomitant heavy menstrual bleeding [19]. In this regard, irregular or heavy menstrual bleeding is a common concern in IUD users, especially in a few months after its insertion. Menstrual irregularity is routinely treated with non-steroidal anti-inflammatory drugs (NSAIDs) and combined oral contraceptive pills [29]. It has been further reported that approximately 94% of levonorgestrel-releasing intrauterine system (LNG-IUS) IUD users and 93% of copper ones have been satisfied with their menses. [30] Nevertheless, prolonged or heavy menstrual bleeding needs to be evaluated to determine the IUD malposition and expulsion, simultaneous pregnancy, uterine perforation, or structural uterine disorders [23, 31, 32].

Most of the women of control group in this study had malpositioned lost IUDs, and were thus in need of retained IUD removal. Such IUDs can cause abdominal pain or irregular menstruation, [33] as reported in this study. As IUDs move spontaneously upward to the uterine fundus over time, [23] it is reasonable to remove the device partially penetrated to the uterine myometrium before it is completely embedded inside the abdomen based on the shared decision-making (SDM) strategy. So it is noticeable point to remove the malpositioned devices with partial myometrial penetration in order to prevent complete uterine perforation as has been taken place in this study.

There were also some important points in this study.

IUDs had also been removed due to unusual changes in Papanicolaou smear (Pap test) results in a small proportion of women. They had undergone cervical cone biopsy or loop electrosurgical excision procedure (LEEP) after IUD removal. No association has been so far observed between human papillomavirus (HPV) infection and IUD use, according to previous studies. [34, 35] In this context, no remarkable relationship was found between HPV infection and IUD insertion in this study, too. However, these women had no Pap test before IUD placement

indicating improper patient selection and less experience of health care providers.

A noticeable group of patients in this study had undergone laparoscopic surgery due to IUD failure and ectopic pregnancy. Of note, IUDs do not increase the rate of ectopic pregnancies and the absolute risk of all types of pregnancy decreases following IUD use. [36] However, in cases of contraception failure, IUD users are more likely to have an ectopic pregnancy rather than other types of contraception. [37] HCPs must be thus aware of the risk of ectopic pregnancy in IUD users. Ultrasound studies in early pregnancy can further determine where the gestational sac is implanted, and help to diagnose its abnormality. This can prevent the delayed diagnosis of ectopic gestation and its related complications, such as massive hemoperitoneum in cases of ruptured ectopic pregnancy as had occurred in some patients in this study. Although there is no evidence to remove IUDs in patients with ectopic pregnancy, [38] all devices were removed in this study.

Laparoscopy is the preferred surgical methods to remove the dislocated intra-abdominal devices. [24] 2-3In patients with hemodynamic instability, emergency laparotomy has been further indicated as that in the present study. Depending on the surgeons' experience, vital sign instability, and intraperitoneal adhesions, most of the surgeries of ectopic pregnancies and embedded devices with uterine perforations had been performed via laparoscopy, and laparotomy had been kept for the patients with severe intraperitoneal adhesions and acute peritonitis.

However, like previous studies, the efficacy of IUDs as a long-acting, reversible, cost-effective contraceptive methods was emphasized here. HCPs' experience was further highlighted as a very important factor in the proper IUD insertion, patient selection, prevention of side effects, as well as in time diagnosis, proper interpretation of invisible IUD string and appropriate management of complications. This is one of the most important points motivated the authors to write this article regardless the presence of several researches in this field. However, the limited number of the cases was evaluated in this study. Undoubtedly, future studies with an adequate sample size in various times of reproductive age including early postpartum IUD insertion and different types of IUSs are needed to determine the efficacy of IUDs regarding their related complications. Since Al-Zahra hospital is a referral center in northwestern of Iran, it may be a strong point of this study due to various complicated cases who refer to this hospital seeking for appropriate management.

## Conclusion

In conclusion, although some serious complications, such as bowel perforation, bladder injury, severe intra-peritoneal adhesions and uterine perforation may occur at the time of IUD use, IUDs are one of the safe methods of contraception all over the world, whose complications can be prevented by careful patient selection and more accurate follow-up visits if more experienced HCPs practice it.

## Abbreviations

IUDs	Intra Uterine Devices
HCPs	Health Care Providers
SD	Standard Deviation
SDM	Shared Decision-Making
Pap Smear	Papanicolaou Smear
LEEP	Loop Electrosurgical Excision Procedure
HPV	Human Papilloma Virus
NSAIDs	Non-Steroidal Anti-Inflammatory Drugs
LNG-IUS	Levo Nor Gestrel-releasing Intra Uterine System

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## Author contributions

The project was designed by F.T, ST\_NH, P.H, R.V and B.KH. Data collection was performed by F.T, R.V and ST.NH. Data analysis was performed by P.H, R.V and B.KH. ST.NH and F.T supervised the data analysis. Manuscript writing was done by F.T and R.V. ST.NH, P.H and B.KH edited the written manuscript. All surgeries were performed by F.T and patients' follow-up was done by R.V and ST.NH. P.H and B.KH referred the patients and helped in patient's follow-up. All authors reviewed the manuscript and approved the final version of the manuscript.

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## Data availability

The data used and analyzed during our study are available from the corresponding author upon reasonable request.

## Declarations

### Ethics approval and consent to participate

Written informed consent was obtained from each participant. This study has been approved by the Ethics Committee of the Tabriz University of Medical Sciences, Tabriz, Iran (IR.TBZMED.REC.1400.686).

### Consent for publication

Not applicable.

### Competing interests

The authors declare no competing interests.

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