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Retained copper fragments following removal of a copper intrauterine device: Two case reports

Marina Dubovis [a,*], Naglaa Rizk [b]

[a] Touro College of Osteopathic Medicine, New York, NY, USA
[b] Ambulatory Services, Bergen New Bridge Medical Center, Paramus, NJ, USA

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ABSTRACT

Intrauterine devices (IUDs) are safe, cost-effective, and reliable contraceptives, and are gaining popularity worldwide. While complications associated with IUD use are rare, they range from expulsion to uterine perforation. Numerous reports have been published regarding the sequelae of intraperitoneal copper IUDs or retained fragments following the removal of a fractured device. No data exist, however, on the intraperitoneal retention of copper following the removal of an otherwise intact IUD. Here we present two patients in whom copper IUDs were found to have missing fragments of copper wire despite removal of an otherwise intact IUD found in utero. We caution providers to examine all removed devices carefully, to surgically address intraperitoneal copper in order to mitigate adhesion formation, and to counsel patients about this potentially serious complication.

1. Introduction

The advent of the intrauterine device (IUD) heralded a new era of convenience and effectiveness in contraception. IUDs currently available in the United States are small, T-shaped plastic devices imbued with varying concentrations of progestins or copper, which are inserted into the uterine cavity by a healthcare provider and left in place for 3–10 years, depending on the device. In addition to the convenience and discretion of a contraceptive which is administered only once every several years, IUDs also confer significant health benefits. Hormonal IUDs are routinely used to treat excessive menstruation and pelvic pain associated with endometriosis and adenomyosis. There are also data to suggest these devices may play a role in the clearance of HPV infection as well as the prevention of gynecologic cancers [1,2].

Given these myriad benefits, it is no surprise that the use of IUDs is on the rise. According to data from the 2015–2017 National Survey of Family Growth, 64.5% of the 72.2 million U.S. women aged 15–49 reported using some form of contraception within the last year. Of those, 10.3% reported using a long-acting reversible contraceptive (LARC) such as an IUD or hormonal implant [3,4]. An analysis of survey data from 2008 to 2014 noted a rise in IUD use from 6% to 14% accompanied by the concurrent drop in permanent sterilization in the same group from 37% to 28%, perhaps suggesting a changing preference toward reversible, less invasive contraception [5].

While IUDs provide a safe, reliable, and convenient contraceptive option with few contraindications, device failure, anatomical variants, and variable provider skill levels contribute to the small but ever-present complication rate. As with virtually any contraceptive method, unplanned pregnancy is a known complication in less than 1% of patients using the copper IUD. Uterine perforation has also been reported in 0.2% of patients in clinical trials of the copper IUD [6]. Device migration, movement of the device outside the uterine cavity, is an uncommon phenomenon which has been reported almost exclusively in case reports. A review of the literature from the last 20 years yielded reports of copper IUD migration to the fallopian tube, omentum, appendix, ileum, sigmoid colon, and bladder. While IUD migration is often discovered incidentally in asymptomatic patients, many patients who are later found to have a migrated IUD initially present with abdominal pain or fistulas which are thought to result from inflammation and adhesions formed in response to copper [7–17].

Intrauterine device fragmentation has been difficult to quantify as data exist primarily in case reports; however, one study estimates the prevalence to be 1–2% [18]. While most fractures are discovered on removal of the device and fractured pieces are promptly removed, we found one case report of a retained hormone release capsule discovered 12 months after the removal of a levonorgestrel-containing IUD [19]. To our knowledge, no report of retained migrated intraperitoneal copper following the removal of an otherwise intact IUD has been published to date. Here we present two patients in whom a copper IUD was

* Corresponding author at: Touro College of Osteopathic Medicine - New York, 230 W. 125th Street, New York, NY 10027, USA.
E-mail address: mdubovis2@student.touro.edu (M. Dubovis).

found to have missing portions of copper wire upon removal of an otherwise intact IUD found in utero and make recommendations for improved patient counseling and candidate selection for IUD use.

2. Case 1

A 40-year-old woman, G3P2012, presented two years previously to a hospital-based gynecology clinic for an annual exam and evaluation of menorrhagia. The patient reported that her menstrual cycle had always been regular. She reported that over the last ten years her periods had become heavier and more painful, with menses sometimes lasting up to 15 days. She reported heavy menstrual bleeding with passage of clots which required her to use 6 or 7 "overnight"-sized sanitary napkins throughout the day and to sleep on a towel. The patient also experienced superficial dyspareunia. The patient had a copper IUD inserted outside the U.S. 10 years previously.

At the initial visit, an annual breast and pelvic exam were done and a Pap smear was collected. Bimanual exam was significant for an anteverted uterus which was mildly tender at the fundus, as well as tenderness of the left adnexa. Notably, the strings of the IUD were not visualized on speculum exam. She was prescribed a 21-day course of Microgestin (1 mg norethindrone acetate and 20 μg ethinyl estradiol) in order to relieve prolonged menstrual bleeding. She also underwent transvaginal ultrasonography which revealed a 1.0 cm posterior intramural myoma and an IUD within the endometrial cavity.

The patient was lost to follow-up for 2 years when she returned to the clinic having experienced little relief from the Microgestin. Previously collected Pap testing was negative for dysplasia and HPV.

Ultrasound images were reviewed with the patient, with special attention to heterogeneous echogenicity of the uterine parenchyma and positive Doppler flow within the myometrium indicative of adenomyosis (Fig. 1). Given the diagnosis of adenomyosis, the established propensity of copper to exacerbate menorrhagia, and duration of IUD use exceeding 10 years, the patient was advised to have the IUD removed immediately.

A repeat pelvic exam again showed tenderness at the uterine fundus. The IUD strings were again not visible on speculum exam, but cervical exploration allowed for localization of the strings and removal of the device with minimal resistance. Upon its removal, the IUD was noted to have missing fragments of copper from the body and one horizontal arm of the device (Fig. 2).

Pelvic X-ray identified a 0.8 cm linear density in the left hemipelvis. The patient then underwent CT of the abdomen and pelvis, with images notable for a 1.0 cm × 0.3 cm metallic foreign body between the uterus and the bladder, as well as a 2 mm phlebolith vs. foreign body in the left hemipelvis, anterior to the uterine cervix (Fig. 3). Images were reviewed and the patient was counseled regarding surgical options for the removal of the fragments given the propensity of copper to form intraperitoneal adhesions.

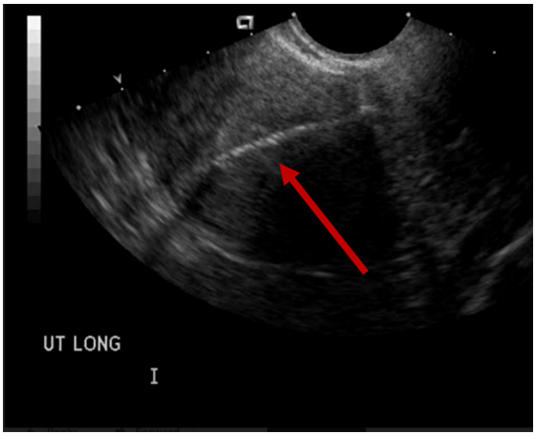

Fig. 1. Patient 1 TVUS with bright linear echogenicity within the uterine cavity (arrow), confirming position of copper IUD.

3. Case 2

A 49-year-old woman, G8P8008, presented to the gynecology clinic for an annual exam. Her obstretric/gynecological history was significant only for 8 uncomplicated spontaneous vaginal deliveries. Her periods had always been regular, without significant pain or excessive menstruation. She had been amenorrheic for four months but denied any associated vasomotor symptoms. She denied any history of abnormal Pap smears or sexually transmitted infections. She reported having had a copper IUD placed at a nearby clinic 8 years previously and requested to have the device removed.

On bimanual exam, palpation of the uterus and adnexa were limited by an obese abdomen. IUD strings were visualized in the cervical os on speculum exam. The IUD was easily removed with minimal traction and the patient tolerated the procedure well. On gross examination, it was noted that the copper coil was missing from the long arm of the device (Fig. 4).

Pelvic x-ray was negative for any radiopaque foreign bodies (Fig. 5). Follow-up CT of the abdomen and pelvis demonstrated a 1.0 × 0.1 cm linear density located adjacent to the uterus on the right subserosal region, along with an incidental finding of a complex cyst of the left kidney.

As with the first patient, images were reviewed and the patient was counseled regarding surgical options for the removal of the retained fragments given the propensity of copper to form intraperitoneal adhesions.

4. Discussion

Many reports have been published documenting migrated IUDs or copper fragments found outside the uterus. To our knowledge, in all such cases the IUD either migrated as whole, likely following uterine perforation, or the IUD was found to have missing horizontal arms upon removal. Here we present two cases of a previously undescribed phenomenon of retained intraperitoneal copper fragments following the removal of a copper IUD found to be otherwise intact in utero.

While we can only speculate as to the events leading to the peritoneal migration of copper coils in the above cases, two explanations stand at the forefront. First, the patients may have suffered uterine perforations on insertion wherein copper fragments broke off in the peritoneum prior to the IUD being pulled back into the uterine cavity. The second explanation is copper degradation and migration outside the uterus. Given that neither patient reported a history of perforation and strings from both IUDs were easily located within the cervix, the former explanation is unlikely.

In vitro studies of copper IUDs provides some insight into the fate of their metal components in utero. Corrosion of copper wire is an expected and necessary event as it allows for copper ions to seep out of the device and exert their contraceptive effects. Electron micrograph studies of used devices demonstrate duration-dependent corrosion detectable after as little as 6 months of use, with the greatest degree of corrosion on the vertical arm of the device. While the exact mechanism is unknown, researchers suggest endometrial secretions near the cervix create a more corrosive environment leading to disproportionate damage to the copper coil on the long arm of the device [20]. Another purported mechanism of degradation is via the presence of *Actinomyces* species, which have been shown to colonize IUDs [21].

In this context it is reasonable to conclude that in both of the above patients the copper coils on the long arms of their IUDs underwent a greater degree of corrosion and ultimately separated from the device. The copper fragments could then have theoretically entered the

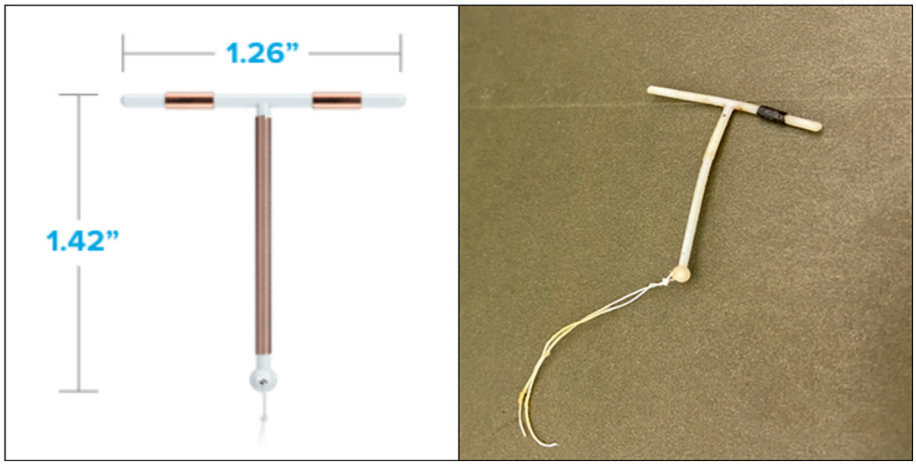

Fig. 2. Left: Manufacturer specifications for Paragard IUD. Right: Copper IUD removed from Patient 1, noted to have missing copper coils from the left horizontal arm and vertical arm of the device.

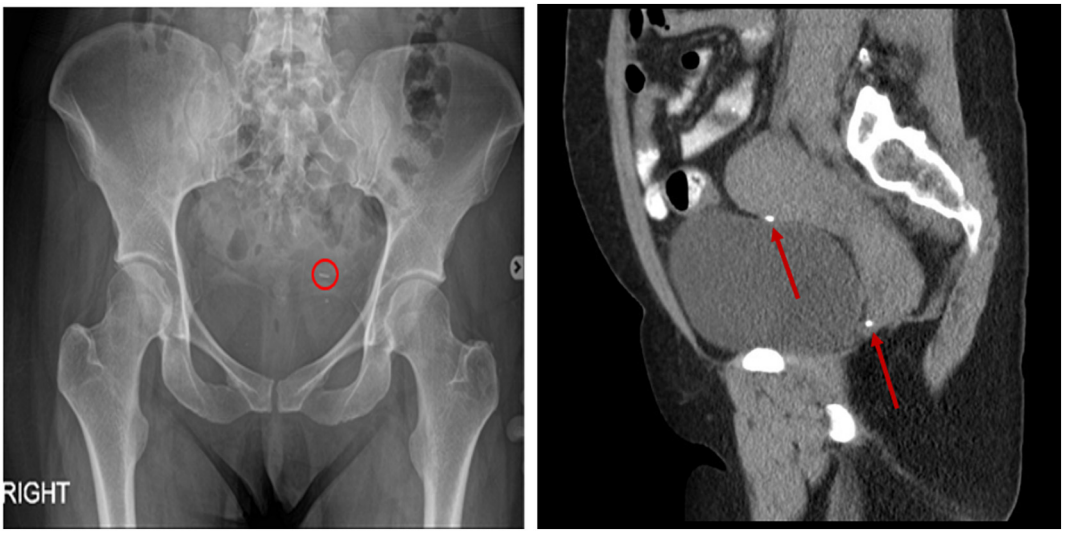

Fig. 3. Left: Patient 1 pelvic x-ray demonstrating a 0.8 cm linear density in the left hemipelvis (circled). Right: Patient 1 Pelvic CT demonstrating 1.0 × 0.3 cm metallic foreign body between the uterus and bladder, as well as a 2 mm phlebolith vs. foreign body anterior to the body of the uterus on the left (arrows).

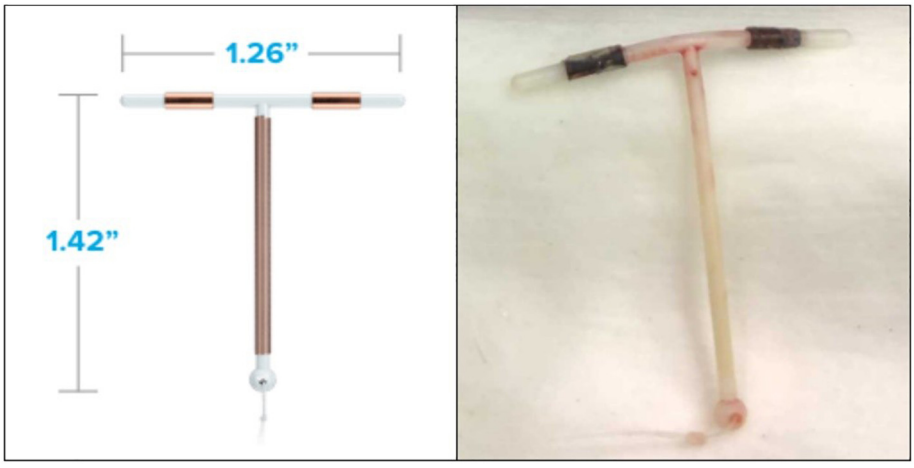

Fig. 4. Left: Paragard Copper IUD. Right: Copper IUD removed from Patient 2, found to have missing copper coil from vertical arm of device.

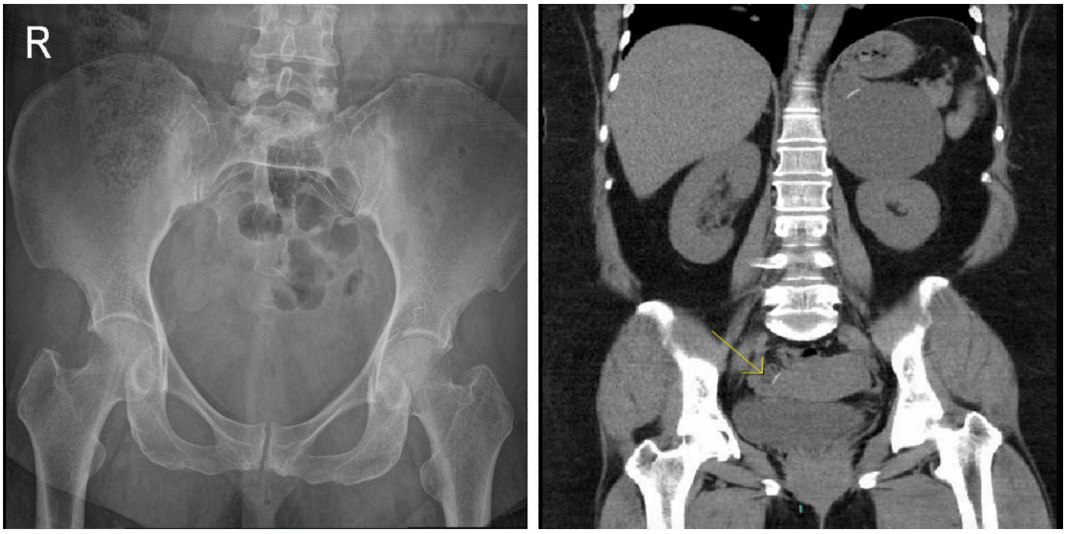

Fig. 5. Left: Patient 2 Pelvic x-ray with no evidence of radiopaque foreign body. Right: Patient 2 CT abdomen/pelvis demonstrating 1.0 × 0.1 cm linear density in uterine serosa on the right (arrow).

peritoneum via the fallopian tube. This hypothesis does not, however, explain why the copper coil was missing from one of the horizontal arms of the IUD in the first case.

As is true of any case series, this work is limited in its generalizability. The patients presented here had very different medical histories, which precludes any conclusions regarding the cause of the copper retention they experienced. Of note, while the second patient had her IUD inserted in a U.S. clinic known to only carry the Paragard, the first patient had her device inserted elsewhere, so we could only speculate as to the nature of her device. Furthermore, while the patients underwent extensive examination and imaging, the removed devices themselves were not cultured or examined under microscopy. Bacterial colonization with species such as *Actinomyces* may have sped copper degradation.

While both patients were receptive to surgical planning for copper fragment removal, the indefinite postponement of all non-emergent surgeries due to the COVID-19 pandemic in our area prevents us from describing surgical findings at this time.

Further analysis of endometrial secretions as well as bacterial colonization as they relate to the degree of wear on the copper wire of an IUD might yield helpful insight into this phenomenon and lead to the development of screening methods to identify appropriate candidates for copper IUDs.

Factors predisposing patients to IUD migration have been difficult to assess, as data on this subject exist mostly in case reports. Prospective cohort studies where objective patient data such as uterine cavity size and position, medical history, and lifestyle are taken into account and examined for associations with device migration will allow providers to counsel patients more effectively.

These cases underline the importance of carefully examining IUDs following their removal. Specifically, providers should ascertain the exact type of device they plan to remove and be aware of all device components, such as copper coils and hormone release capsules. In a 1987 report on intrauterine devices, the World Health Organization recommended the prompt removal of migrated IUDs even when discovered incidentally in an asymptomatic patient [22]. This recommendation is especially poignant for patients using copper IUDs given the established propensity of copper to induce inflammation and adhesion formation within the peritoneum. While the IUDs we encountered in the above cases were found in utero, we feel this work allows for the extension of the WHO recommendation to include removal of any retained copper following the removal of a copper IUD. Providers should strive for prompt minimally invasive copper fragment removal as patients in whom intervention is delayed ultimately require more invasive procedures. While we present evidence for the previously theoretical complication of retained copper fragments following the removal of a copper IUD, we stress the rarity of such complications and the continued safety of IUDs. It is our hope that this report will also inform the counseling of future patients regarding the risks of copper IUD use. Given that copper IUDs are composed of a polyethylene backbone and three copper coils, patients should be notified of the risk of these additional components separating from the device when compared to the hormonal or plain IUD. Furthermore, patients should be advised they may require surgery to remove any retained copper fragments in order to mitigate dangerous sequelae such as adhesion formation.

Contributors

Marina Dubovis is the primary author.
Naglaa Rizk was the attending physician, mentor and editor.

Conflict of interest

The authors declare that they have no conflict of interest regarding the publication of this case report.

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Obtained.

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