Role of 3-D Ultrasound in Assessment of Correlation between Position of Intrauterine Contraceptive Device and Post Insertion Uterine Bleeding

Thesis

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بسم الله الرحمن الرحيم

قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا

إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم

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Abstract

IUCD is the most widely used contraceptive method in the world. In 1995 it was reported that IUCDs were used by over 100 million women in the world, and is considered the second most reliable method of contraception after oral hormonal contraceptives. The first IUCD was introduced by Richter in 1909 since then many types of IUCDs were introduced.

The future IUCDs include the Ombrelle-250 and Ombrelle-380 which was designed to be more flexible to reduce expulsion and side effects, the device is especially suited for nulligravid and nulliparous women . A new system was being developed combined with a reservoir for the sustained release of levonorgestrel used for perimenopausal women.

The contraceptive action of all IUDs is mainly in the uterine cavity. ovulation is not affected, and the IUD is not an abortifacient. It is currently believed that the mechanism of action for IUDs is the production of an intrauterine environment that is spermicidal.

Key Words:

Intrauterine Contraceptive Device, Abnormal Uterine Bleeding In IUCD Users, Three-dimensional ultrasound

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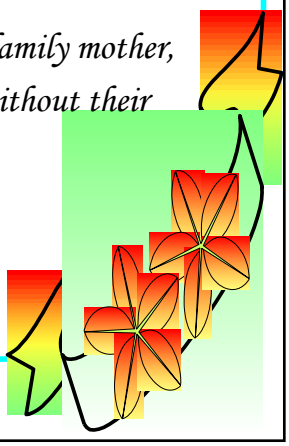
Last but not least, I dedicate this work to my family mother, father, brothers, sisters, my husband and my children without their sincere emotional support, this work

could not have been completed.

Fadia Abdalla Antar



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2D Ultrasound	:	Two-Dimensional Ultrasound.
2D-TVS	:	Two-Dimensional Transvaginal Ultrasound.
3D Ultrasound	:	Three-Dimensional Ultrasound.
3D-TVS	:	Three-Dimensional Transvaginal Ultrasound.
CT	:	Computerized Tomography.
IR-CU-IUD	:	Indomethacin-Releasing Copper Intrauterine Device.
IUCD	:	Intrauterine Contraceptive Device.
IUCD-ED	:	Intrauterine Contraceptive Device-Endometrial Distance.
IUCD-FD	:	Intrauterine Contraceptive Device-Fundus Distance.
IUCD-MD	:	Intrauterine Contraceptive Device-Myometrial Distance.
LNG-IUCD	:	Levonorgestrel Intrauterine Contraceptive Device.
MBL	:	Menstrual Blood Loss.
MRI	:	Magnetic Resonance Imaging.
NSAIDs	:	Non Steroidal Anti-Inflammatory Drugs.
PI	:	Pulsatility Index.
PID	:	Pelvic Inflammatory Disease.
PPV	:	Positive Predictive Values.
RI	:	Resistance Index.
STIs	:	Sexually Transmitted Infections.
TVS	:	Transvaginal Ultrasound.
US	:	Ultrasound.
VCI-C	:	Volume Contrast Image in the C Plane.
VPV	:	Negative Predictive Values.

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Introduction

The first intrauterine contraceptive device was introduced by Richer in 1909 ***(Sujuan et al., 1994)***, since then, it is increasingly adopted as a reliable method of contraception by over 100 million women in the world as it is one of the most efficient and reversible methods of birth control with the additional advantage of low cost and long duration of use ***(Valsky et al., 2006 and O'Brien et al., 2008)***.

However, in the first year after insertion, between 5 and 15 % of women will have their IUD removed because of irregular uterine bleeding which have been attributed to the effect of contact between the device and the endometrium and even the pressure on the uterine muscle. The disharmonious relationship between the uterus and the IUD is the cause of most of the bleeding complaints, so bleeding is related to improper position rather than the contraceptive method itself which should be excluded before abandoning the IUD for any other method of birth control ***(De Kroon et al., 2003)***.

The use of ultrasound waves as a diagnostic medical tool began in the United States in the early 1950's. Since the early 1970's, ultrasound has been used to document the presence of the IUD inside the uterus. In the mid 1980's and 1990's, the development of high frequency transvaginal scanning improved the accuracy of gynaecological ultrasound in identifying the IUD position in the uterus but 2D-US cannot visualize structures that are not located in one single plane simultaneously thus problems such as IUD incarceration and lateral displacement and incomplete opening of both arms of the IUD can be missed, actually 2D-US may fail in the detection of 9% of IUD malposition which paved the way for application of 3D-TVS in displaying the spatial position of the IUD in relation to the uterine cavity. 3D–TVS allows complete

simultaneous imaging of all parts of the IUD; the shaft and the arms in the coronal plane which was impossible to visualize before. This brings an entirely different diagnostic perspective for the evaluation of the IUD position in the uterus ***(Kalamantis et al., 2009)***.

We directed our study on two groups of patients; a group of asymptomatic IUD users and another group having bleeding complaints after using IUD to investigate the relation between the IUD position in the uterus and irregular uterine bleeding using 2D and 3D-TVS.

Our study aimed at assessing the role of 3D-US in correlating the position of IUD and bleeding complaints related to IUD use. We want to examine the ability of 3D-US to explain the reason of abnormal uterine bleeding in some of the IUD-users which 2D-US failed to find its cause by displaying the undetected cases of malposition to avoid abandoning this safe method of contraception. Our second aim is to detect the cut-off values for normal position of the IUD beyond which the IUD should be removed as bleeding complaints will significantly increase. We aim at decreasing unnecessary removal of mildly displaced IUD.

Aim of the Work

To evaluate the role of three dimensional (3D) ultrasound in assessment of the correlation between the position of intrauterine contraceptive device (IUCD) and abnormal uterine bleeding.

The Historical Review on Development of Intrauterine Contraceptive Device (IUCD)

A frequently told story, assigns the first use of intrauterine contraceptive devices (IUCD) to caravan drivers who allegedly used intrauterine stones to prevent pregnancies in their camels during long journeys. The forerunners of the modern intrauterine contraceptive device (IUCD) were small stem pessaries used in the 1800s. small button-like structures that covered the opening of the cervix and that were attached to stems extending into the cervical canal ***(Fritz,, 2005).***

In 1909, ***Richter*** in Germany reported success with a silkworm catgut ring that had a nickel and bronze wire protruding through the cervix ***(Richter, 1909).*** shortly after, Pust combined Richter's ring with the old button-type pessary and replaced the wire with a catgut thread ***(Pust, 1923).*** In the 1920s, ***Grafenberg*** removed the tail and pessary because he believed this was the cause of infection. He reported his experience in 1930, using rings made of coiled silver and gold then steel ***(Grafenberg, 1930).***

The ***Grafenberg*** ring was associated with a high rate of expulsion. This was solved by ***Ota*** in Japan who added a supportive structure to the center of his gold or silver-plated ring in 1934 ***(Ota,1934).***

In 1962, ***Jack Lippes*** introduced the lippes loop which was one of the most widely used IUCDs in national family planning programmes. It has serpentine "double S" configuration and was the first to have a nylon threads attached to the lowest part of the device. This made it easier to remove, and it was also possible to verify, by simple vaginal examination that IUCD was in the uterine cavity ***(Lippes, 1962).***

The Dalkon Shield was introduced in 1970, within 3 years a high incidence of pelvic infection was recognized. There is no doubt that the problems with Dalkon shield were due to defective construction (multifilament tail providing a pathway for bacteria to ascend). Pointed out as early as 1975 by ***Tatum (Tatum, 1975).***

The Modern Intrauterine Contraceptive Device :

The addition of copper to the IUCD was suggested by ***Jaime Zipper*** of Chile, whose experiments with metals indicated that copper acted locally on the endometrium ***(Zipper et al., 1969)***. ***Howard Tatum*** combined ***Zipper's*** suggestion with the development of the T-shape to diminish the uterine reaction to the structural frame and produced the copper-T the first copper IUCD had copper wire wound around the straight shaft of the T, the TCu-200 (200 mm of exposed copper wire) also known as the ***Tatum-T (Tatum, 1983).*** More copper was added by the population council investigators, leading to the Tcu-380A (380 mm of exposed copper surface area) with copper wound around the stem plus a copper sleeve on each horizontal arm ***(Sivin and Tatum, 1981).***

Types of Intrauterine Contraceptive Device :

Unmedicated IUCDs :

The lippes loop made of plastic impregnated with barium sulfate is still used throughout the world (except in United States). Flexible stainless steel rings are widely used in China but not elsewhere ***(Sujuan et al.,1994).***

Medicated IUCDs :

Copper IUCDs :

The first copper IUCDs were wound with 200 to 250mm of wire and two of these are still available: the Tcu-