AN INNOVATIVE TREATMENT OF ENDOMETRIOSIS WITH THE USE OF PLASMA TECHNOLOGY- CASE REPORT

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ABSTRACT

Background. Endometriosis is a condition, in which the endometrial cells grow outside the uterus. It is a cause of chronic pain, which may disturb a woman’s well-being. In addition, women suffering from endometriosis often remain infertile. The treatment is problematic and the disease has a tendency to recur.

Case Report. The patient was a 41 - year old woman with diagnosed endometriosis in the scar after caesarean section. The implant caused boring and burning pain (10/10 points in the Visual Analogue Scale for pain). The endometriosis was surgically treated with the use of Plasma Technology. The time of hospitalization was 4 days. During the period of a 6 month observation, the patient did not have any pain complaints and re-surgery was not necessary.

Conclusion. The use of innovative argon plasma method enabled to dissect the entire implant of endometriosis with no intraoperative or postoperative complications. The surrounding tissues were undamaged. After 5 years of suffering the patient remained pain-free and her mental condition ameliorated.
BACKGROUND

Endometriosis is a condition, in which the active endometrial-like tissue occurs outside its physiological location (uterus cavity) [1]. Its aetiology still remains unknown, despite many presumed theories including the theory of retrograde menstruation, the theory of stem cells and genetic background [1, 2]. The World Health Organization estimates that it may concern even 15% of women, mostly at reproductive age. The most common symptom is the chronic pelvic pain. Other symptoms include dysmenorrhea, dysuria, and dyspareunia. Women with endometriosis often suffer from infertility [3]. It is estimated, that 30 to 50% of women with endometriosis are infertile [4]. Additionally, mentioned symptoms may cause the worsening of a patient’s general mental and social well-being including work-absenteeism [5].

The treatment of endometriosis should be considered individually. Age, symptoms, fertility and complications should be regarded. The therapy involves pharmacological treatment, surgery, or a combination of those two. Hormonal treatment includes GnRH agonists, oral contraceptives, androgens, aromatase inhibitors, selective progesterone receptor modulators. An additional analgesic therapy consists of non-steroidal anti-inflammatory drugs and opioids. Surgical treatment of endometriosis is preferred among infertile patients, or those with severe symptoms [6].

The innovative technique of surgical treatment of endometriosis involves the use of Plasma Technology. The PlasmaJet system (Plasma Surgical Limited, Theale, Berkshire, UK) has been firstly used in 2004. Since then it has been practiced in many specialties across Europe and North America [7]. In Poland, the first successful use of neutral plasma in gynecology took place on 19th of November 2015 in Woman’s and Child’s Health in Zabrze. It was performed by Jerzy Sikora MD Ph.D. Prof. and Mariusz K. Wójtowicz MD Ph.D. The healthcare personnel had been previously trained in performing surgeries with the use of argon plasma in Rouen, France. Currently, the experience of the Center counts 18 months and 36 operated patients.

This study presents the case of a 41-year old patient surgically treated for endometriosis with the use of Plasma Technology.

CASE REPORT

In July 2016 a 41-year old patient suffering from endometriosis in the scar after caesarean section reported to the Gynecological Clinic. Her past medical history involved caesarean section in 2005 because of obstetrics reasons (prolonged progress of labor). About 5 years after the caesarean section, the pain started and she has been diagnosed with the endometriosis in the scar after caesarean section. Her therapy consisted of hormonal treatment and non-steroidal anti-inflammatory drugs. Although there were no results of the chosen method during the next 2 years and the implant had enlarged, it was not possible to treat her surgically. From 2011 to 2016 she was suffering from severe pain, which was augmenting and hindering her everyday functioning and exacerbating her mental state.

In July 2016 on admission on physical examination, a tumor the size of two male fists was observed in the abdominal layers. The implant extended between the pubic symphysis and the point located 3 fingers below the umbilicus. The skin covering the tumor was wrinkled and rugged.

The patient complained of severe, long-term pain localized in the hypogastric, umbilical and left and right iliac regions of the abdomen. Additionally, the pain was localized in the lower back area (lumbosacral region of the back). The pain was boring, burning, the patient assessed it as 10 points at the 10-point Visual Analogue Scale for Pain (VAS). It was not connected with menstruation, it occurred permanently. In addition, she complained of pain during defecation.

The diagnostic process consisted of gynaecological examination, magnetic resonance (MR) of lesser pelvis, transvaginal and abdominal USG, the Papanicolaou test, measurement of Ca 125, and blood examination.

The MR showed a tumor, located in the scar after caesarean section with a high possibility of endometrial character. The tumor covered the skin, the subcutaneous tissue, and the fascia. A possibility of infiltrating the intestines was indicated. There were no other abnormalities. The Ca-125 marker measured 140,40 U/ml (N= 0,00-35,00 U/ml). The results of blood examination and the Papanicolaou test didn’t reveal any abnormalities.

She was qualified to undergo a surgery with the use of Argon Plasma Technology, which was performed on 14th December 2016.

Under general anesthesia, the operating field was prepared and the abdominal skin was incised across in order to dissect the entire scar after the caesarean section. About 3 fingers below the umbilicus and 2 fingers above the pubic symphysis, within the subcutaneous tissue and the fascia of rectus abdominis muscle, there was a visible tumor with the size: 100 mm x 80 mm. It was lifted by the vulsellum in order to expose the margins of the implant. The tumor was removed using the Plasma knife from the subcutaneous tissue and the fascia. The rectus abdominis muscle, peritoneum, and abdominal organs were not infiltrated. The Argon Plasma enabled to remove the implants precisely and ably, with the absence of bleeding. The remaining implants located on the rectus abdominis muscle’s fascia were vaporized with the use of Plasma alike. The material was sent for histological examination. The haemostasis was controlled and the fascia, the subcutaneous tissue, and the skin were sutured.

There were no intraoperative or postoperative complications. The patient was released from the hospital 4 days of hospitalization (3 days after the surgery) in good general condition. Additional post-operative pharmacological therapy (GnRH agonists) was implemented. Up to now (6 months of observation), the patient has not complained of pain or any other symptoms.
**DISCUSSION**

Plasma is ionized matter, similar to gas and like a gas, it does not have definite shape or volume. Unlike gas, plasma is electrically conductive, produces and reacts with electromagnetic fields. Although plasma consists of positively charged nuclei, which swim in a “sea” of freely-moving disassociated electrons, in a macroscopic scale it is electrically neutral. Plasma is created by adding energy to gas. Heating matter to high temperatures causes electrons to leave the atoms, resulting in the presence of free electrons. The result is a high-energy, low-density state. In surgery, the effect of ionization of a noble gas (argon) takes place in the device used by the surgeon. We obtain 2cm of plasma stream, that has high kinetic energy, high temperature and causes the effect of luminescence enlightening the operating field. The effect depends on the distance from the tissue. A surgeon may by regulating the distance either dissect, coagulate or vaporize [8].

Standard monopolar electrosurgery causes the appliance of the electric current into the patient which may cause a burst of surrounding tissues. [9,10,11]. Because of electrical neutrality, plasma does not cause a current flowing through the tissues and the depth of penetration is minimal. Minimal tissue damage has been checked in few studies and an average depth of penetration has been estimated between 0.1 mm and 2.0 mm [11, 12, 13, 14].

As the plasma knife influences superficially the operated tissues, it may be used successfully to vaporize serum membrane and bigger tissue malignancies alike. Furthermore, it allows complete superficial destruction of the implants [13].

The undoubted advantage of the neutral plasma is the fact, that it is a no-touch technique. That eliminates the risk of accidental disruption of the tissues. The possibility of perforation is low, even when the plasma is used to treat thin-wall structures. A certain convenience of the plasma system is the possibility of controlled graduation of the depth of thermal penetration. In addition, the tip of the device always has the temperature similar to human body temperature and that prevents the surrounding tissue from being thermally injured. Thanks to the opportunity of rapid and overall coagulation of superficial bleeding, the plasma system is used to coagulate even widespread bleeding and the whole blood loss decreases.

Furthermore, the operating field is well-enlightened by both: the luminescence effect and the minimal amount of produced smoke.

The studies show, that although all tissues demonstrate healing regardless of the technique used (electrosurgery, argon beam, plasma knife), those treated with the PlasmaJet System are characterized by smaller scar and lack of negative effect on surrounding tissues [15].

On the other hand, the plasma surgery requires a longer time of the operation, because of the elongated moment of the tissue dissection. What’s more, currently the costs of a plasma device and training of personnel are high.

**CONCLUSIONS**

Plasma knife is a perfect method used in surgical treatment of endometriosis. This innovative technique becomes an irreplaceable method of treatment in deep endometriosis and endometriosis located in places that are not accessible by standard methods. The goal of the treatment should be to eliminate the risk of endometriosis recurrence, re-surgery and additionally to treat infertility.

Although there is limited data about the use of plasma device in the treatment of endometriosis, it may be considered as a safe and effective method [11, 16]. Further research and a long-term observation of the patients should be performed in order to derive more precise conclusions and to assess whether it may replace standard technologies [13]. Center of Woman’s and Child’s Health in Zabrze is currently the only unit in Poland, where patients can be treated for endometriosis with the use of Plasma Technology. Women with a history of multiple laparoscopies often report to Zabrze seeking assistance in the hope of returning to a life without pain. The presented case shows that the argon neutral plasma may be the solution to their problems.

**CITE THIS AS**

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**REFERENCES**

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LIST OF THE VIDEOS

Video 1  An innovative treatment of endometriosis with the use of plasma technology