
# ANNUAl REPORT 2020

International Society of Minimally Invasive and Virtual Surgery

# ISMIVS 2020 Annual Report

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# I. Opening Remarks

## 1.1 From the Honorary President, Prof. Lang Jinghe

With over seven years of unremitting efforts since the founding of the International Society of Minimally Invasive and Virtual Surgery (ISMIVS) in 2013, the cause of minimally invasive and noninvasive medicine continues to thrive with relevant activities in full swing. What has happened proves that the development of minimally invasive and noninvasive medicine shall be based on three major principles:

**1.To build and strengthen the philosophy and guiding principles of minimally invasive and noninvasive medicine**

Hippocrates, the Father of Medicine, once said: "First, do no harm". It is a basic principle and a humanistic philosophy for medicine, especially for surgery, which has become our self-discipline not to harm or harm less when treating patients or performing surgeries. We have also proposed four principles of protection: to protect tissues, protect organs, protect functions and protect mental wellness. The four principles are vital for both patients and doctors. The development from invasiveness to noninvasiveness is not only a reflection of technical revolution, but also a new height of rationality. We have preserved the uterus for thousands of patients with uterine fibroids and/or adenomyosis with minimally invasive and noninvasive technologies and treatments. We must fight for the uterus instead of performing hysterectomy unanimously.

**2.To bring out and promote the technologies and treatment modalities of minimally invasive and noninvasive medicine**

We have seen a significant progress in the technologies and treatment modalities of minimally invasive and noninvasive medicine in recent years, From endoscopic surgery to HIFU surgery (HIFUS), as well as from CLS and LESS to NOTIS or NOSIS. We may not find the best technology, but with the relentless technological development of minimally invasive and noninvasive medicine, we will definitely find a better and better technology! Meanwhile, we shall also improve the technical training and strengthen the doctor workforce to cultivate more doctors with better understanding and master of the philosophy and technologies of minimally invasive and noninvasive medicine.

**3.To facilitate and develop global exchanges and cooperation in minimally invasive and noninvasive medicine**

ISMIVS is the best demonstration for global exchanges and cooperation. Our colleagues from different countries in various fields have joined hands to cultivate friendship and foster global exchanges and help each other, a perfect practice of building a community with a shared future for humankind.

With our concerted efforts, I have complete trust in the minimally invasive and noninvasive medicine in reaching a better and near future!

Prof. Jinghe Lang
Academician, Chinese Academy of Engineering (CAE)
President, Chinese Obstetricians and Gynecologists Association (COGA)
Honorary Director, Ob-Gyn Department, Peking Union Medical College Hospital (PUMCH)

## 1.2 From the President, Prof. David Cranston

Over 2000 years ago Mencius The famous Chinese philosopher said *"Compassion for fellow humans is a matter of the heart, and righteousness is the path".*

Compassion is often relayed by touching which has always been considered an important part of healing. Something that has become more difficult during COVID but it is also one of the potential problems with increasing medical technology which has tended to increase the distance between the doctor and patient, and has now gone so far that a doctor or nurse may remain in their office while the patient is in another building. The mechanisation of scientific medicine is here to stay, but we need to be careful that we do not forget the patient who may well feel that the doctor is more interested in his disease than in himself as a person. Sir William Osler was a Canadian physician and one of the founding fathers of Johns Hopkins Hospital in the USA but ended his career as Regius Professor Medicine in Oxford. His greatest legacywas taking students to the bedside to talk to the patients, famously said:

*'The good physician treats the disease, the great physician treats the patient who has the disease'*

However one of the advantages in the development of technology can be summed up in another of William Osler's sayings:

*"Diseases which harm require treatments which harm less".*

And it is important for those of us who are involved in innovations to prove that they harm less than the treatments they are aimed at treating and think first aboutw the patient and second about the disease.

Sun-Tzu in his famous book "The Art of Warfare" spoke of courage wisdom humanity and integrity as being the traits of a true commander,

and as doctors we are fighting a war against disease, and not just Covid, so these traits should be seen in us too, and as we find better and less invasive ways to treat diseases with courage wisdom and integrity, let us also remember our humanity and treat every patient as an important individual.

Best Wishes,

David Cranston D.Phil.,FRCS.

President

International Society of Minimally Invasive and Virtual Surgery (ISMIVS)

## 1.3 From the Secretary-General, Prof. Lian Zhang

Dear Colleagues,

2020 is an extraordinary year because of COVID-19, which has swept the world and changed people's lifestyles. To fight this pandemic, the entire medical community has made great efforts and sacrifices. 2020 marks the 7th anniversary of the founding of the International Society of Minimally Invasive and Virtual Surgery (ISMIVS). Over the past 7 years, ISMIVS has been committed to spreading and practicing the concept proposed by Sir William Osler — "Diseases that harm require therapies that harm less". ISMIVS holds the belief that the development of medical civilization will make the treatment more minimally invasive and even noninvasive.

This is the first time for ISMIVS to release its annual report (ISMIVS 2020 Annual Report). The timing carries special significance. The pandemic makes it impossible for us to get together to share and learn in traditional ways, but through the Internet,we have kept "face-to-face" communication and study in ways that are greenest, most convenient, most economical, and most efficient. On 8 March, International Women's Day, we held the world's first multi-center tele-medicine HIFU treatment event themed on "Focusing on Women's Health". Afterwards, we held 4 webinars jointly with the Asia-Pacific Association for Gynecologic Endoscopy and Minimally Invasive Therapy (APAGE), and co-organized another 3 webinars respectively with the Arabic Society of Fetal Medicine and Surgery (ASFMS), the Indonesian Gynecological Endoscopy Society (IGES), and Société de Chirurgie Gynécologique et Pegvienne (SCGP, French Society of Pelvic Surgery), which stimulated widespread enthusiasm and heated discussions. Meanwhile, with the consent of some speakers of the 2019 Yangtze International Summit of Minimally-Invasive and Noninvasive Medicine (ISMINIM 2019), we made a video collection of lectures and released it to the public, hoping that online sharing will make learning of new technologies and new developments of minimally invasive and noninvasive medicine more accessible. The Third International Training Workshop on Focused Ultrasound Therapy for Tumors (2020 HIFU Workshop), originally planned to be held in Bulgaria in October 2020, was temporarily postponed due to the pandemic. However, the training on the application of new technologies should not stop for the current travel restrictions. After half a year's preparation, the training courses on focused ultrasound therapy were uploaded to the ISMIVS website in November, 2020 and were shared with APAGE. ISMIVS welcomes doctors interested in these courses to apply for online training to learn this technology so as to provide patients with a new treatment option.

In order to spread the founding concept of ISMIVS and share the latest advancements in minimally invasive and noninvasive technologies through multiple channels, ISMIVS optimized its website and launched a number of official accounts in 2020 at Facebook, LinkedIn, YouTube and WeChat, and. changed its quarterly newsletter into amonthly one starting in July 2020,so that followers can keep abreast of the latest developments of ISMIVS and thecutting-edge advances in minimally invasive and noninvasive technologies. It is delightful to see that ISMIVS has been followed and acknowledged by an increasing number of doctors. Another task on our 2020 agenda was to publish a special issue dedicated to focused ultrasound ablation in collaboration with the International Journal of Hyperthermia. Currently, the manuscripts are under review and will soon come out.

I believe that with the advent of the COVID-19 vaccine and universal vaccination, the infection rate and death rate will be greatly reduced. Though the restoration of the world order will allow us to communicate offline, I believe that online communication will be an even bigger part in our work and life since it is more convenient and more economical. In 2021, ISMIVS will continue to do its utmost to carry out offline and online activities, to enhance cooperation with other professional societies of minimally invasive surgery, and contribute to medical progress and patients' well-being.

I wish you all the best and good health in 2021.

Prof. Lian Zhang
Secretary-General
International Society of Minimally Invasive and Virtual Surgery (ISMIVS)

# II. The Purpose of ISMIVS and Interpretation of the Purpose

## 2.1 The Purpose of ISMIVS

The goal of the International Society of Minimally Invasive and Virtual Surgery (ISMIVS, previously known as International Society of Minimally Invasive and Noninvasive Medicine) is to promote and develop the highest standards of clinical practice in the field of minimally-invasive and noninvasive therapeutic medicine through education and research, under the guidance of the ideology of minimally-invasive and noninvasive medicine, i.e. “Diseases that harm require therapies that harm less.”

ISMIVS seeks to provide physicians and allied health scientists and technologists with scientific and educational programs and materials of the highest quality, and to constantly improve the content and value of these scientific and educational activities.

ISMIVS seeks to promote research in all aspects of minimally-invasive and noninvasive medicine and related sciences, including clinical research in the promotion of quality and personalized healthcare.

ISMIVS seeks to foster closer fellowship among all members in the different branches of minimally-invasive and noninvasive medicine and greater cooperation among all members and allied healthcare professionals.

ISMIVS seeks to promote the concept of heath defined by the World Health Organization: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity".

## 2.2 Interpretation of ISMIVS Purpose by Prof. Zhibiao Wang, Director of National Engineering Research Center of Ultrasound Medicine (NERCUM)

### Minimally-invasive and noninvasive medicine: Treatments—Minimize harm to patients

**1.Theoretical basis of minimally-invasive and noninvasive medicine**

**1.1.The minimal and optimal structural composition of the human body**

Millions of years of human evolution has sculpted the human body into its present state: a minimal, integral, simplest yet most precise structure known to the mankind. As such, the body will not be structurally sound and intact in the absence of any individual unit in each and every phase of its growth and development of a human life. The layout of its tissues, the morphology of its organs and even the connection between its cells are of extreme precision that displays the heavenly beauty of God's gift.

For example, the traditional medical view of the organ “appendix” has been that not only does it bear no beneficial physiological functions to the human body, but it also often causes harm and pain due to its high incidence of inflammation. Therefore, this organ is customarily removed when diagnosed with inflammation, or resected as a useless organ during a laparoscopic surgery, or should be, as suggested by

some, removed at the birth of a child as a preventive measure. This view remained unchanged for centuries until only a few years ago when new insights into the functions of the appendix had been discovered. It is now known that the appendix, being rich in lymphoid tissues, containing B cells and T cells, resembles the bursa of Fabricius structure of a bird. It should be categorized as an organ of the central immune system that could play an eligible role in triggering the two major immune functions of the body: cell-mediated immunity and humoral immunity. The latest research further revealed that the appendix also has secretory cells that can secrete various substances including digestive enzyme and growth-related hormones [1].

Structural damage to the body would unavoidably inflict impaired body functions. Therefore, the most desirable medical treatment option would be the one that yields minimal damage to the structure of an organism. Only so, can the structural integrity of tissues and organs be conserved to the fullest, which exemplifies the highest respect for the natural evolution, as well as for the ever growing knowledge of medical sciences.

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### 1.2.The goal of medical treatment is to maximize the natural self-healing power for fighting against the disease

As early as the 4th century BC, Hippocrates, the founding Father of Medicine, cautioned doctors, “Do not over do” since “the primary goal for doctors to exercise their medical skills is to cure the person who has the disease. Among all options to achieve this goal, the simplest one should be selected [2]”. He articulated, “Nature is the rehabilitee of the disease”[3]. Underlying the naturopathy of Hippocrates is the message that nature is a consummate and orderly entirety governed by its inherent laws, and any damage to its order may bring disasters [4].

Hippocrates's wisdom is echoed in the philosophy of "Strengthening body resistance to dispel pathogenic factors [1]", a central tenet of Traditional Chinese Medicine (TCM), which accentuates the significance of conquering disease by nurturing the natural healing power within the body [5]. This belief of TCM, is an insightful interpretation of the plain truth of minimally-invasive and noninvasive medicine.

Thus, the development of a disease and the recovery from it are both a self-organization process for the human body. Then the purpose of medical treatment is to use the minimal intervention to maximally mobilize the naturwal healing power within the body for fighting against the disease.

### 1.3.The core concept of minimally-invasiveness and noninvasiveness: Treatments—Minimize harm to patients

The appearance of body structures such as ribs and abdomen, during the course of evolution of human body, is an adaptation to protect or minimize the viscera from incurring the external injuries. The escaping response induced by a pain sensation displays the utmost desire to be saved from injury. "Diseases that harm require therapies that harm less [6]." As such, patients are entitled to receive treatments that are improved towards being "safer, more effective, more comfortable and more efficient". "Treatments: Minimize harm to patients" wherein lies the very essence of the minimally-invasive and noninvasive medicine and will meet the renewed expectations of the patients. In a broad sense, medical treatment involves not only diagnosis and treatment, but also embodies the verbal expression and the behaviors of the medical professionals.

We should not be satisfied with inflicting no or little damage to the body structures in the "operation" path; attention should also be given to minimize destruction to the structure of tissues and/or organs around the lesion in the targeted organ during an operation-like procedure. Simply because that the damage to the abdominal wall should not be neglected. Take an example of the operative treatment of the paramedian incision in the hypogastrium. The very first incision would result in the loss of continuity in the skin and breakage of ramus cutaneous anterior, the subcutaneous blood vessels and lymph-vessels of intercostal nerve and the subcostal nerve. Further incision and divulsion of abdominal wall would cause the sequential ripping apart of the fat layer, muscle layer, fascia and peritoneum, most of which will be marked by permanent scars during the tissue repair process. What these scars speak to us are the irrevocable damage to the normal structure in each layer of the abdominal wall, which, in turn, will have functional consequences, such as reduced skin sensation and muscle weakness due to denervation. Worse still, along with the scars, the inherent biomechanical properties of the abdominal wall are altered, leaving "weak spots" on the abdominal wall, thus lowering the labor capacity. In some severe cases, abdominal wall hernia may occur. The longer the incision, the more severe is the damage, and the more adverse impact on the postoperative general health state.An excellent solution for abdomen operation path has been worked out since last century: the surgical "incision" procedure was replaced with laparoscopic "perforation". In a laparoscopic surgery, pore canals at three discrete sites are made (now single-port laparoscopy has been developed). Compared with incision surgery, the laparoscopic surgery no longer produces continuous damage to the abdominal wall or disruption of the overall tissue organization. It has the additional merits of speedy recovery. From the end of last century to the beginning of this millennium, a noninvasive surgical-like method, the high-intensity focused ultrasound (HIFU) treatment, has being developed that has the capability

to deliver treatment to the internal targeted organ extracorporeally limiting the desired damage only to the lesions within an organ. This noninvasive procedure, not only leaves negligible or no damage to the structures on the operation path, but also preserves the surface of the target organ unscarred. At the completion of such surgery, the abdominal wall is cosmetically and functionally intact and the quality of life and labor capacity of patient are not compromised. The development of this HIFU procedure exemplifies the essence of "Treatments—Minimize harm to patients".

The principle of "Treatments—Minimize harm to patients" embodies the following: (1) the treatment option of choice can effectively eliminate the source of the disease thus in turn reduce its threat to the well being of the patient; (2) the treatment option of choice causes minimal harm to the patients when it is deployed; and (3) the ratio of the benefits of treatment to the harm is maximized.

The harms resulted from a surgical procedure include both the physiological and the psychological damages, with the latter may suffer from damage to the outer appearance, the loss of an organ or the discomfort experienced during the treatment. Therefore, the following factors should be taken into account for the treatment planning: (1) to weigh in the pros and cons of the different treatment options to determine whether a treatment is required, and if so what will be the optimal treatment of choice that will minimize the harms; (2) once a treatment option is identified, one needs to weigh in the balance between the "completeness" of the treatment to eradicate the disease and the "harms" it will inflict for achieving such completeness. Finding such balance is the key to determine the appropriate level of a given treatment. For example, hysterectomy can improve the quality of life by eliminating menorrhagia resulted from myoma, but if the loss of womb

would significantly lower the quality of life for the depression it might cause, uterus-preserving myomectomy will be a more appropriate choice. Along the same line, breast cancer, can be cured by radical operation or modified radical operation through excision of part of the breast or excision of the whole breast based on tumor staging. Both operations are of curative intent. However, both will result in drastic appearance change that could lead to severe psychological trauma. This is the form of unspeakable "harmfulness" of treatment that in the past, many patients would avoid to incur. Now as required by the patients, reconstruction of damaged breast is adopted to restore the appearance, thus reducing or eliminating the debilitating impact on mental health of a cancer patient.

"Treatments—Minimize harm to patients" is a philosophy that governs every aspect of medical practice. From a surgical point of view, it involves not only the selection of the means and levels of surgery, but also includes every procedure performed in the entire process. To be specific, care must be taken to make sure the surgical paths follow the physiological gaps without separating parenchymal tissue; surgical procedure involving sharp dissection (causing incision injury) is preferable over blunt dissection (causing laceration); if applicable, one hemostat is preferred over two for hemostasis; in the operation, dressing is pressed, but not brushed to prevent brush-burn. Humans are emotional beings. A patient's perception to harms associated with a treatment is heavily influenced by his/her psychology. If medical professionals can provide clearer explanations and more consolation, patients will have less negative feelings and more confidence about the treatment outcome.

**2.Technological development shaped by the minimally-invasive and noninvasive ideology**

Only when we whole-heartedly embrace the creed "Treatments—Minimizes harm to patients", can we develop medical technologies in accordance with the belief that "respect for life begins with respect for the integrity of each tissue and organ of the body", and enable the patients to maximize natural resistance against diseases as soon as possible. In technological sense, it can be articulated as: the less harm the treatment does to the structure and the function of human body, the better. The course of development of surgical treatments for fibroid best exemplifies the dynamic evolution process of the concept of minimally-invasive and noninvasive medicine.

### 2.1.Trans-abdominal and trans-vaginal pan-hysterectomy

The birth of hysterectomy has alleviated the fibroid patients from excessive loss of blood caused by over menstruation, and has saved the lives of numerous women. The past 100 years have witnessed the continuous technological improvements to this surgical procedure driven by the ideology of minimally-invasiveness and noninvasiveness.

From 1880 to 1895, abdominal pan-hysterectomy was continually improved, especially in hemostasis and cervical stump treatment. In 1989, L.A. Stimson from New York introduced ovarian and uterine ligations to effectively reduce angiorrbagia during abdominal hysterectomy [7]. In the early 20th century, surgeons tried to achieve a better operative incision without compromising operative field. In 1900, Hermann Johannesburg Pfannenstiel described his transverse incision, which was superior in assurance of elegant appearance, and reduction of abdominal hernia compared with the traditional longitudinal incisions [8]. In 1941 Leonid Sergius Cherney suggested a modified low transverse abdominal incision whereby the rectus muscle was cut at its very insertion into the pubus to provide better access to the space of Retzius [9].

In 1928, Edward H. Richardson from Johns Hopkins Hospital published his simplified abdominal hysterectomy, claiming that this perfect technology, after 4 years of development, succeeded in minimizing death rate and only incurred rare incidence of post-operative complications [10].

Under the guidance of the concept of minimally-invasive and noninvasive medicine, laparohysterectomy has been constantly improved to allow for even shorter operation time, less damage to surrounding tissues, shorter anesthesia time and less hemorrhage during operation.

### 2.2.Laparoscopic surgery

Harry Reich first reported the first successful case of laparoscopic hysterectomy in 1989 [11]. Ever since then, multiple laparoscopic surgical techniques have been developed thanks to improved optical and illumination systems and more efficient energy transmission, yielding better cosmetic results, faster postoperative recovery and postoperative pain relief. The treatment can be accomplished by "perforation", freeing patients from the pain caused by "abdominal incision".

### 2.3.Uterine artery embolization

In 1974, the first successful attempt of using uterine artery embolization (UAE) saved a fibroid patient suffering from lethal vaginal bleeding, who was intolerant to surgery. In 1989, Dr. Ciraru-Vigneron, a gynecologist from Lariboisiere Hospital in Paris, started cooperation with Dr. Jacques Merland, and they both joined in the research team led by Dr. Ravina. In 1995, Dr. Ravina et al. publicized 16 cases of selective application of uterine arterial cannula embolization as a substitution of surgical resection to cure fibroid. In 12 of these cases, the volume of fibroid shrank by 20-

80% accompanied by a significant decrease of menstrual blood volume [12].

The emergence of the uterine artery embolization (UAE) has freed some of the patients from treatment that involves “incision” or “perforation” in that only treatment by “thrusting needle” is required, which embodies the concept of “Treatments: minimize harm to patients” in terms of operation path.

### 2.4.High-intensity focused ultrasound (HIFU) ablation

Early in the 1950s, William Fry and Frank Fry envisioned in vivo treatment with extracorporeal focused ultrasound [13-15]. However, not until the 1990s was this dream turned into reality by a team of researchers from PR China, led by Professor Zhibiao Wang. Their main contributions include: (1) proposing the concept of “Biological Focal Region” (BFR) [16]. The Team found through in vitro and living animal experimentations that the shape and size for coagulative necrosis of HIFU were related to ten variables including shape and size of Acoustical Focal Region, focused angle, sound intensity, sonication time, tissue depth, tissue structure, and tissue function. They have worked out the equation VBFR = f (VAFR, h, l, t, D, Tstructure, Tfunction), and established a database describing the formation of biological focal region from HIFU within different tissues and organs. (2) Preliminary explorations of focused ultrasound dosimetry. Wang's team had produced a large number of experimental studies to prove that thermal ablation dosage differs greatly for different tissues. For example, under the same HIFU intensity, sonication depth and sonication volume, the EEF required for renal tissue is seven times of that for muscle. To keep the treatment dosage within the safe and effective range, this team has come up with the expression for the measurement of BFR and the dosage for the ablation of tumor and proposed the “Energy Efficiency

Factor" (EEF) [17], EEF = gTD/V = gPt/V (J/mm3) as the baseline dosage parameters for HIFU treatment. Based on clinical data accumulated from years of vigorous testing in vitro and in living animals, a dosage database [18] for the treatment of part of the tissues and organs was established, paving the way for the broader clinical use of HIFU. (3) Putting forward the idea of "Acoustic Environment in Tissue". In 2003, Wang's team proposed the concept of "Acoustic Environment in Tissue" (AET) [19]. Acoustic Environment in Tissue refers to an environment jointly constituted by the tissue structure and functional state of ultrasound transmission, the tissue structure and functional state upon interaction and the mutual interference of ultrasound itself. Research of AET and modification of AET via physical or chemical methods can significantly improve the efficiency of treatment and may potentially lead to breakthroughs in future HIFU treatment technology.

This team has developed the world's first therapeutic HIFU system, the Model JC Focused Ultrasound Tumor Therapeutic System, for the extracorporeal treatment of tumors, and has since pioneered its clinical applications in treating benign and malignant tumors. This world's first HIFU system was collected by by the National Museum of China in December, 2020.

Professor Timothy Mason ascribed the Chinese team's leading position in therapeutic HIFU to its ability to account for the multi-factor influences that cannot be explained by currently available theoretical models [20]. It was reported at the 1st International Summit on Therapeutic Ultrasound (ISTU) in 2009 that cancer patients treated with HIFU due to failure in surgery had reached their 10 years' of tumor-free survival. China has become worldwide the only country capable of providing such data owing to its enduring research and clinical application in this field [21].

The past several years have witnessed some major breakthroughs in the clinical deployment of HIFU ablation: (1) replacement of general anesthesia with sedatives. While 15 years ago, the HIFU treatment required general anesthesia, it was replaced with local anesthesia 10 years ago and is now replaced with sedatives. In the whole process of treatment, patient remains conscious and capable of communicating with the doctor. (2) The treatment efficiency is improving steadily. This is evident by the reduction of sonication time of a 5 cm tumor from 10 h 15 years ago to 7 h 10 years ago and to 4 h 7 years ago and to now, less than 30 min to 1 h. This leap forward in reduction in treatment time is made possible through equipment optimization, treatment protocol optimization, and the development of a training scheme for HIFU doctors. (3) 15 years ago, ribs would have to be cut to allow HIFU treatment for some tumors, which is no longer a requirement for any indication. (4) Skin-burn is minimized to an insignificant level. 15 years ago, superficial second degree skin burn would happen to 50% of the patients, and serious burn to very few, but now only slight burn will occur in 0.14% of the patients and the skin of most patients would remain intact upon the completion of treatment [22]. (5) Continuous improvement of therapeutic protocols. With unceasing explorations, modifications and improvements, Wang's team has developed a sound therapeutic regimen based on proper scanning modes, dosage control, effectiveness and safety evaluation [23]. We are convinced that we will have safer, more effective, more comfortable and more efficient HIFU treatment in the future through technological innovations driven by the ideologies of minimally-invasive and noninvasive medicine.

Focused ultrasound ablation requires no penetration of surgical instruments into human body, which is a minimally-invasive and

noninvasive treatment judging from the perspective of its operation path. However, as this therapy involves thermal ablation of tissue by the focusing point (the "knife point"), poor focusing or "knife point" movement may also cause damages to non-targeted tissue during the treatment which may have to be remedied with surgical operations. Therefore, focused ultrasound ablation must be performed under the guidance of the principle of minimally-invasive and noninvasive medicine so as to maximally destroy the lesion and to optimally protect the normal tissue [24].

## 3.Boosting the development of the discipline of minimally-invasive and noninvasive medicine

To accelerate the development of minimally-invasive and noninvasive medicine, and to promote academic exchanges on the latest achievements and trends in fundamental research and clinical applications in this field, "The 1st Yangtze International Summit of Minimally-invasive and Noninvasive Medicine" (ISMINIM 2013) was held in Chongqing. Organized by Chongqing Medical University (CQMU) and National Engineering Research Center of Ultrasound Medicine (NERCUM), this Summit revolved around the theme "Treatments: Minimize harm to patients". With Professor Franco Orsi from European Institute of Oncology as the Academic Committee Chair, the Summit attracted from over 20 countries and regions a total of around 900 experts and scholars in the field of minimally-invasive and noninvasive medicine. The key topics discussed included the progress and improvements in the clinical applications of laparotomy, endoscopic surgery, radio-frequency ablation (RFA), trans-catheter arterial embolization/trans-catheter arterial chemo-embolization (TAE/TACE), and high-intensity focused ultrasound (HIFU) under the guidance of minimally-invasive and noninvasive concept. The Summit also bore witness to the inauguration of the "International Society

of Minimally-invasive and Virtual Surgery (ISMIVS)" (previously known as the International Society of Minimally-invasive and Noninvasive Medicine, ISMINIM), which elected Professor Franco Orsi as its Founding Chairman, and Professor Lang Jinghe from Peking Union Medical College Hospital as the Honorary Chairman. At the conference, the first Council was established, the Council Members were elected and the Charter of ISMIVS was approved by the Council Members. ISMIVS will strive to provide doctors engaged in the field with a more inclusive and regular platform for academic exchange [25].

At the conference, the experts reached a broad consensus that the very existence of technology serves for the materialization of certain medical concepts and protocols and for the satisfaction of the maximum demands of the patients. Minimal invasiveness and noninvasiveness is more about the guiding principle behind a technology than about the technology itself. The choice of a technology for treatment should be guided by the principle of minimally-invasive and noninvasive medicine so as to provide maximal destruction of the lesion and optimal protection of the normal tissues. In the 21st century, the concept of "Treatments: Minimize harm to patients" informed by minimally-invasive and noninvasive medicine represents the need of both the human civilization and the progress of medical sciences.

The establishment of ISMIVS marked the actual birth of the discipline of minimally-invasive and noninvasive medicine. To date, the Yangtze International Summit of Minimally-invasive and Noninvasive Medicine has been held four times. Prof. David Cranston from University of Oxford has been elected as the President of ISMIVS since 2017 at the 3rd Yangtze International Summit of Minimally-invasive and Noninvasive Medicine.

## 4.Prospect

Medical professionals should keep an eye on the experience of the patients instead of concentrating efforts on treating the disease alone. The first prescription we make for our patients should be care [26], which embodies the profound philosophy of minimally-invasive and noninvasive medicine. Hippocrates argued that the will of the patients to fight against the disease is a form of treatment that can get rid of the pathogens [27]. Recently, an investigative report from UK has also pointed out that "the best treatment is no treatment", and it is actually a process of seeking for a new kind of medical wisdom [28].

As Professor Mengsun Yu pointed out in his paper [29]: looking back on the development of western medicine in the last century, we observed that western medicine remained forward-looking during the first world health revolution featuring infectious disease control. However, with rapid social and economic development, the western medicine which focuses on the disease itself became impotent in the face of the rampant prevalence of diseases associated with unhealthy lifestyles, resulting in the unbridled rise in global medical expenses. The reason is traceable in the reductionistic mentality and the antagonism in the funding ideology of western medicine. Consequently the inborn self-organization function of the human body is neglected. Professor Yu proposed that we should retool our thinking and shift our attention to the integrity and the detection, identification, monitoring and control of patients' general disorder for the purpose of helping the patients to re-establish their self-organization function. He believes that removing the disease is a natural defense function of an organism, including the human being.

The human body is the minimal self-organization structure to ensure its own healthy existence. Therefore, we need, on the one hand, conduct

localized treatments that maximally preserve tissue and/or organ integrity, on the other hand, we must encourage the patients to bring out their natural resistance against the disease and to restore the body's self-organization function. This is the core message of minimally-invasive and noninvasive medicine, which transcends medical treatment in its traditional sense and have broader significance for human civilization.

Please see Appendix 7 for references.

# III. Integrated Development of Minimally Invasive and Noninvasive Medicine

## 3.1 From Prof. Rudy Leon De Wilde, Director ESGE

Dear Members of the International Society of Minimal Invasive and Virtual Surgery,

Your Society (ISMIVS) has the outstanding goal to promote minimal- and non-invasive therapies. Just like the shift in cancer therapy to more individualized tailored concepts, just like the drawback from laparotomy towards laparoscopy as way of entrance in abdominal surgery many decades ago, we are now on the verge of an even more positive experience in reducing trauma when dealing with benign diseases of the uterine wall.

The European Society for Gynecological Endoscopy (ESGE) with more than 5,000 members in over 60 countries has inaugurated under the presidency of Prof. Grigoris Grimbizis an official Working Group (ESGE-WG) to explore the safety and efficacy of novel techniques to treat ubiquitous problems like myomata and adenomyosis. Especially novel aspects like the high-frequency ultrasound ablative therapy are in the focus of this ESGE-WG.

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Because of the high experience and huge amount of data in China and Asia, this ESGE-WG is proud to be able to cooperate with your honorable Society in future,in order to further improve gynecological surgery for the well-being of our patients. After the COVID- pandemic, we will surely be able to join forces with common scientific meetings and publications to follow.


With greetings of Dr. Hugo Christian Verhoeven, Chairman of the ESGE-WG, Dr. Rajesh Devassy, International Advisory Board of the ESGE, sincerely Yours,

Prof. mult. Dr. mult.
Rudy Leon De Wilde
Director ESGE,
CMO Pius Hospital,
Carl von Ossietzky University,
Oldenburg, Germany.

## 3.2 From Prof. Chyi-Long Lee, Chairman of Board of Trustees, APAGE

Dear members of International Society of Minimally Invasive and Virtual Surgery (ISMIVS),

International Society of Minimally Invasive and Virtual Surgery (ISMIVS) has pursued the goals of education for gynecologists in minimally invasive and non-invasive surgeries, dedicating to promoting well-being of patients. The close collaboration between APAGE and ISMIVS is one of the most significant milestones in gynecological treatments all over the world. In 2019, APAGE has signed the strategic cooperation between ISMIVS and NERCUM, aiming to promote the education and training in high intensity focused ultrasound (HIFU). We are very honored to cooperate with ISMIVS.

APAGE was formed in 2003 by a group of committed endoscopists from the Asia-Pacific region (Chyi-Long Lee, Bao-Liang Lin, Pong Mo Yuen, Lee Keen Whye, Joo-Hyun Nam, Felix Wong, C.Y. Liu, Prashant Mangeshikar), who recognize the needs to share research achievements and further professional training in gynecological endoscopy. Our members are not only in the Asia-Pacific region but throughout the world. APAGE holds several Laparoscopic Gynecologic Oncology & Reproductive hands-on workshop and magnificent Annual Congress every year for providing all experts with practical training and a platform to exchange their experiences. We as well as have accredited training centres in Minimally Invasive Gynecology in many Asian countries to ensure the health care quality.

At the 20th APAGE Annual Congress 2019 in Chongqing, we have arranged the pre-congress HIFU workshop and HIFU session for gynecologists in the Asia- Pacific region to absorb the latest HIFU knowledge and surgical techniques. In 2020, even during the COVID-19 pandemic, APAGE and ISMIVS have held a series of HIFU webinars. We were honored to invite experts from all over the world, such as Prof. Lee Keen Whye, Prof. Felix Wong, Prof. Zhang Lian and Prof. Osamu Tsutsumi, etc. to share topics— “HIFU and fibroid” and “HIFU Spotlight on Adenomyosis & Infertility.” Participants from more than 30 countries attended the webinars and provided positive feedbacks, which is very encouraging and motivating.

“For some things a foot may be too short, and for the others an inch will suffice”. Laparoscopic surgery and HIFU are complementary to each other. In the past 20 years, the advancement of gynecologic surgeries has developed rapidly. In addition, the improvement of the quality of life for patients has become more important. NOTES and non-invasive

treatments such as HIFU will receive much attention as patients pursue less and minor wounds. Nowadays, minimally invasive and non-invasive surgeries are the trends for treatment, which also play the important roles in the field of gynecology.

We will devote ourselves to the education and training of HIFU continuously. In 2021, the accreditation of medical doctors and training centres in ultrasound guided HIFU will be announced officially. In the collaboration with ISMIVS, more and more gynecologists could get the opportunity to learn practical techniques, communicate with each other that are interested in HIFU, and have a deeper understanding of the HIFU treatment.

Sincerely,
Chyi-Long Lee, MD., PhD.
The Chairman of Board of Trustees, APAGE

## IV. ISMIVS: Annual Review 2020

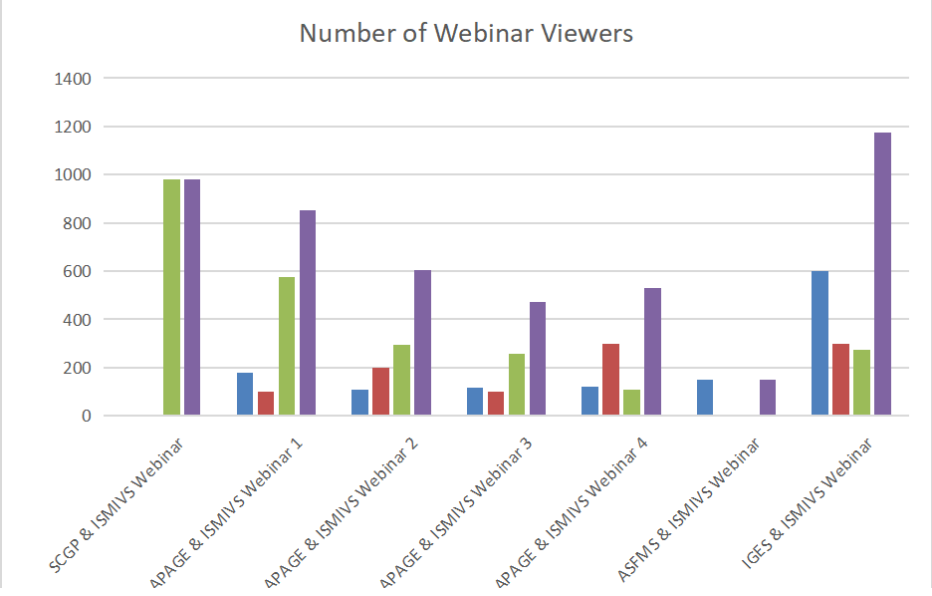
**Our work in 2020, in numbers**

**2** non-profit events;
**7** online academic symposiums;
**20** online training courses (**11** in Chinese and **9** in English);
**4** new online platforms for publicity and communication (Facebook, LinkedIn, YouTube and WeChat)
**24** video recordings of lectures at the 2019 Yangtze International Summit of Minimally-Invasive and Noninvasive Medicine (ISMINIM 2019);
**8** ISMIVS Newsletters with **80** online posts with **20,000** views;

**6,800** visits to ISMIVS website;
**73** Facebook posts with **10,600** views
**19** Facebook video streams with **6,000** views;
**25** YouTube video streams with **2,000** views;
**46** LinkedIn posts with **5,100** views.

| Number of Webinar Viewers | | | | |
|---|---|---|---|---|
| Webinar | Live Broadcast | | Playback | Total |
| | Zoom | Da Yi Wei Ke* | YouTube | |
| SCGP & ISMIVS Webinar | 0 | 0 | 982 | 982 |
| APAGE & ISMIVS Webinar 1 | 177 | 100 | 577 | 854 |
| APAGE & ISMIVS Webinar 2 | 110 | 200 | 294 | 604 |
| APAGE & ISMIVS Webinar 3 | 117 | 100 | 257 | 474 |
| APAGE & ISMIVS Webinar 4 | 123 | 300 | 107 | 530 |
| ASFMS & ISMIVS Webinar | 150 | 0 | 0 | 150 |
| IGES & ISMIVS Webinar | 600 | 300 | 274 | 1174 |

*Da Yi Wei Ke:"大医微课",
an online medical education platform in China)



## 4.1 Two non-profit events

### 4.1.1.International Women's Day-HIFU Event 2020(IWD-HIFU 2020)

Themed on "Care for Women", IWD-HIFU 2020, the world's first multi-center HIFU treatment event, was held on March 8, 2020 to celebrate the International Women's Day and pay tribute to women across the globe. 41 hospitals both at home and abroad performed HIFU procedures at the same time.

In response to the call by Dr. LEE Keen Whye from Singapore, to remind us to care for women's health and to pay a tribute to women across the globe, especially at the current challenging times of the COVID-19 outbreak, the International Society for Minimally-Invasive and Virtual Surgery (ISMIVS) and the National Engineering Research Center of Ultrasound Medicine of China (NERCUM) co-organized and initiated an"IWD-HIFU" project on March 8, 2020.

"The World is preoccupied with fighting COVID-19, climate change and economic uncertainties. However, women's health and wellbeing should not be overshadowed by these events. While we cannot avoid sufferings of women caused by nature and sickness, we should lessen their pain with whatever means we can provide.

We honour women with accolades like mother tongue, mother nature, mother earth and motherland. Let us pay tribute on International Women's Day and honour women with "Mother Womb", which is truly our very first home. Science has enabled us to conserve the womb affected by many illnesses and diseases, let us come together as medical professionals to save Mother Womb and lessen her sufferings"

This proposal came out of an OB-GYN's care for female patients, and a son's gratitude to his mother.

**Dr. Lee Keen Whye**

Founding Director of Singapore O&G and
Medical Director of HIFU Centre,Farrer Park Hospital, Singapore.

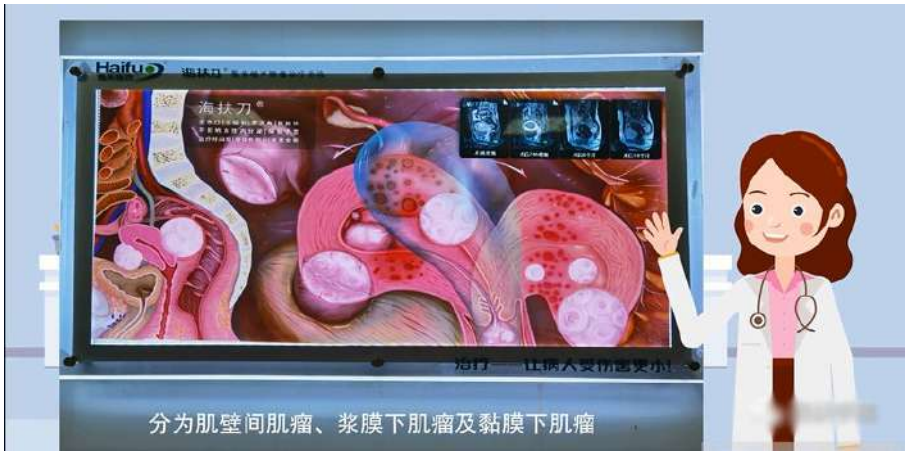
**李建威医生**

新加坡O&G妇产医疗集团创始理事
新加坡斐瑞医院HIFU中心医疗主管

### 4.1.2.Patient Education Campaign for Focused Ultrasound: Uterine Fibroids (in mainland China)

**A science popularization contest to disseminate the general knowledge of focused ultrasound for uterine fibroids was held in August, 2020.**

To encourage doctors to help patients know more about uterine fibroids in different ways, ISMIVS, NERCUM and FUS Training Center co-organized a video stream contest. Chinese doctors were invited to bring the knowledge of uterine fibroids to patients by using the fibroid model set, so that the patients could have a clearer sense about the position, volume and even weight of the fibroids. Patients also learned about how the HIFU ablation therapy would be performed and how the focused ultrasound would work inside the fibroids. Videos from 25 hospitals were received, with over 100,000 views in total. This non-profit event aimed to encourage more medical professionals to think and innovate from patients' perspectives, thus leading to more effective communications between them.




Video streams participating in the contest


Online Voting


The Judges

## 4.2 Online Academic Conferences

ISMIVS together with other 4 Societies hosted 8 online conferences. If you are interested , please watch the playback or refer to Appendix 1 for the summaries of the lectures.

## 4.2.1.ISMIVS-SCGP HIFU (ISH) Special Webinar 2020


A Virtual Conference on Focused Ultrasound Ablation of Uterine Fibroids and Adenomyosis was convened with the joint efforts of Société de Chirurgie Gynécologique et Pegvienne (SCGP, French Society of Pelvic Surgery) and ISMIVS for the first time and attracted the OB-GYN experts from 13 French-speaking countries including France.

## 4.2.2.APAGE-ISMIVS HIFU (AIH) Webinar Series 2020


To foster academic exchanges in the new field of minimally invasive and noninvasive surgeries, the Asia-Pacific Association for Gynecologic Endoscopy and Minimally Invasive Therapy (APAGE) and ISMIVS co-organized an APAGE - ISMIVS HIFU (AIH) Webinar Series, which consists of 4 episodes starting from June 11, 2020 to July 23, 2020.

Chaired by Prof. LEE Keen Whye (Singapore), a Founding Member of APAGE, this Webinar featured renowned OBGYNs in the Asia-Pacific region on their views of the management of uterine fibroids and adenomyosis as well as HIFU experts on their ideas of HIFU treatment. Here are the links for your playback:


For the playback of the webinar,
please click the link below:

https://www.youtube.com/watch?v=UJlmHFzqMI


For the playback of the webinar,
please click the link below:

https://www.youtube.com/watch?v=SMhxXxCWRrw

### 4.2.2.3.Episode 3


For the playback of the webinar,
please click the link below:

https://www.youtube.com/watch?v=4DABS_EWljg


For the playback of the webinar,
please click the link below:

https://www.youtube.com/watch?v=5JeQ0RJIy3E

## 4.2.3.ISMIVS joined ASFMS Academy Webinar

ISMIVS joined the Arabic Society of Fetal Medicine and Surgery (ASFMS) in holding the ASFMS Academy Webinar on August 13, 2020.



For the playback of the webinar, please click the link below:

https://youtu.be/zWnRBTv7EoU

## 4.2.4.IGES-ISMIVS Webinar 2020


On September 27, 2020, the Indonesian Gynecological Endoscopy Society (IGES) and ISMIVS co-organized an online conference themed on "From Minimally Invasive to Non-Invasive Surgery-The Latest Advancement in Gynecology". Participating experts shared and discussed the latest advances in non-invasive therapies represented by ultrasound-guided focused ultrasound therapy and gynecologic laporoscopy.

**For the playback of the webinar, please click the link below:**

https://www.youtube.com/watch?v=HvMABPMMz2E

## 4.3 HIFU Training Courses

ISMIVS is pleased to announce the availability of a series of online training courses on the clinical application of noninvasive focused ultrasound therapy. A variety of courses related with ultrasound-guided high intensity focused ultrasound (USgHIFU) ablation of uterine fibroids will enlighten doctors about the physics and biological effect of HIFU, case screening, clinical protocol, anesthesia plan, nursing care, etc. In the meantime, more courses on focused ultrasound therapy of other diseases will be uploaded in the future, please follow us on www.ismivs.org for what you are interested in.

The training courses are accessible only to part of ISMIVS members. If interested, please contact the Secretariat: jennyzhang@isminim.org

HIFU training course that have been available online:

- 1.Introduction to Haifu Focused Ultrasound Tumor Therapeutic System
- 2.The Physics and Biological Effect of HIFU Ablation
- 3.In Vitro Animal Experiment: The Correlation between HIFU dosage and HIFU Ablation Effect
- 4.MRI Features of Pelvic Diseases
- 5.Techniques for Understanding MR Images and Its Clinical Application in HIFU Ablation
- 6.HIFU Treatment of Uterine Fibroids: Clinical Protocol
- 7.Case Study on HIFU Ablation of Uterine Fibroids
- 8.Sedation and Analgesia Planning for HIFU Ablation

Please see Appendix 3 for detailed information about each course.

## 4.4 The Collection of Lectures of the Fourth Yangtze International Summit of Minimally-Invasive and Noninvasive Medicine (ISMINIM 2019) Available Online

From July 12 to 14, 2019, the Fourth Yangtze International Summit of Minimally-Invasive and Noninvasive Medicine (ISMINIM 2019) was held in Chongqing in association with the Annual Meeting of the Minimally Invasive and Noninvasive Medicine Committee of Chinese Medical Doctor Association (CMDA) and the Forum of Reproductive Health Society, China Preventive Medicine Association. Around 800 guests from 29 countries and regions, including China, Britain, Germany, Spain, South Korea, Egypt, and Bulgaria, attended the event. Two hundred and thirty inspiring lectures on the topic of the cutting-edge treatments in minimally-invasive and noninvasive medicine were delivered within two days.


With the permission of the experts, the Yangtze Summit Lecture Collection (containing 19 lectures) has been prepared and launched online, with the aim of giving access to doctors and patients around the global to learn the progresses in minimally-invasive and noninvasive medicine during the pandemic.

Following are the lectures available online:

1. HIFU and Rectosigmoïd Endometriosis
   Dr. Charles-André Philip (France)
2. HIFU treatment in myomatosis and uterine adenomyosis: our experience Dr. Andrea Ferrero (Argentina)
3. HIFU treatment combined with hysteroscopic endometrial ablation for the treatment of heavy vaginal bleeding in multiparous patients Dr. Chonghyeok Yoon (South Korea)
4. Effectiveness and Safety of USgHIFU for Uterine Fibroids: An Eleven Years' Experience Dr. Jordi Rodriguez (Spain)
5. Application of high-intensity focused ultrasound ablation to patients with hepatocellular carcinoma and cirrhosis Dr. Tan To Cheung (Hong Kong, China)
6. High Intensity Focused Ultrasound in Oxford 2002-2019
   Prof. David Cranston (UK)
7. The introduction of HIFU technology and its development
   Dr. Lee Keen Whye (Singapore)
8. HIFU treatment application in Egypt Dr. Mohamed Hamed (Egypt)
9. HIFU in Pancreatic and Liver Tumors: Comparative Study versus Chemotherapy Alone and Treatments in Difficult Locations
   Dr. Joan Vidal Jove (Spain)
10. Uterus-sparing surgery for giant fibroids through a small incision
    Dr Eduardo Alfredo Sánchez Cavero (Peru)
11. Focused Ultrasound v MIS for Fibroid Treatment
    Dr. Michael JW Cooper (Australia)
12. HIFU-clinical Experience of 500 cases in Chung Shan Medical University Hospital Dr. Tsung-Ho Ying (Taiwan, China)
13. Imaging of various uterine leiomyoma Dr Kuan-Gen Huang (Taiwan, China)
14. The Deserving Opponent- NOTES and HIFU
    Chyi-Long Lee (Taiwan, China)

15. The Evolution of Surgery for Prostate Cancer Prof. Freddie Hamdy (UK)
16. Do we need a micro air bubble? Dr. Kim Tae Hee (South Korea)
17. HIFU treatment can change the world Felix Wong (Hong Kong, China)
18. Ten Years of HIFU Treatment on Uterine Fibroids in Europe Results and Perspectives Dr. Antoni Pessarrodona Isern (Spain)
19. Introducing of the focused ultrasound surgery in the clinical practice of Bulgaria as the treatment option of the advanced pancreatic cancer patients by Dr. Dobromir Dimitrov (Bulgaria)

Please subscribe ISMIVS in YouTube for the lectures above.

# IV. ISMIVS: Work Plan 2021

## 5.1 IWD-HIFU 2021


Date: March 2, 2021

Event: IWD-HIFU 2021

Theme: Focusing on Women's Health and Inspiring the World with Warmth

Event information: 128 global HIFU Centers performing noninvasive uterus-sparing HIFU treatment for more than 120 patients with uterine fibroids and/or adenomyosis with a Summit talk on Noninvasive Uterus-Sparing Treatment held at the same time

## 5.2 Online Academic Conferences


Date: March 19, 2021

Webinar: "HIFU Application in Obstetrics and Gynecology"

Co-organized by: ISMIVS and Philippine Society of Therapeutic High Intensity Focus Ultrasound in Obstetrics and Gynecology (PSTHIFUOG)


Date: April 24, 2021

Webinar: "Non-Surgical Treatment of Uterine Disorders"

Co-organized by: The Society of Gynaecology and Obstetrics of Nigeria (SOGON), the ESGE Working Group on Non-Surgical Ablative Therapy of Benign Uterine Disease, ISMIVS and the Physicians Roundtable (PRT)

Date: May 28, 2021

Webinar: “HIFU and Africa”

Organized by: ISMIVS


Webinar: APAGE-ISMIVS HIFU (AIH) Webinar Series 2021

Organized by: APAGE and ISMIVS

Episode 1

## 5.3 Online Training Courses: Global Experience Sharing

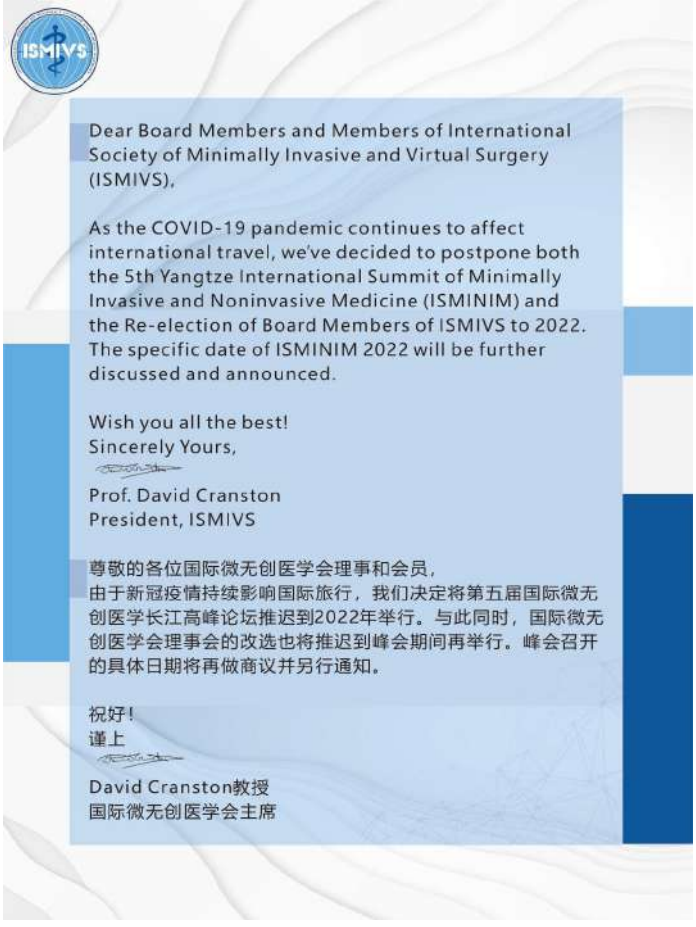
In 2021, ISMIVS will continue to enrich the our online training courses. Courses mentioned below will be accessible on our official website. You can follow our LinkedIn and Facebook for latest information.

- 1. Impact of Focused Ultrasound Ablation of Uterine Fibroids and Adenomyosis on Fertility: Case Report
- 2. Diagnosis and Differentiation of Benign and Malignant Tumors: Experience Sharing
- 3. Difficult Cases For Focused Ultrasound Treatment: Experience Sharing
- 4. Focused Ultrasound Therapy during the Pandemic: Experience Sharing
- 5. Indications and Patient Screening for Focused Ultrasound Therapy
- 6. Management of the Adverse Reactions after Focused Ultrasound Treatment: Case Report
- 7. From William Osler to Minimally Invasive and Noninvasive Medicine
- 8. Excision of Uterosacral Ligament Endometriosis and Adenomyomectomy.
- 9. uterine vein tear and how to deal with it
- 10. Prevention of pelvic adhesions after TLH
- 11. Total laparoscopic hysterectomy for stage 3 and 4 endometriosis
- 12. Tips and tricks in performing laparoscopic surgery-port placement
- 13. Different techniques of insertion of the first trocar

**Stay tuned for more courses.**

## 5.4 The 5th Yangtze International Summit of Minimally-Invasive and Noninvasive Medicine: Postponed to 2022

Due to the restrictions on international travel caused by COVID-19 Pandemic , the 5th Yangtze International Summit of Minimally Invasive and Noninvasive Medicine, originally planned in July, 2021, is now postponed to 2022. Specific schedule will hinge on the lift of travel restrictions. Please wait for future announcement.



Dear Board Members and Members of International Society of Minimally Invasive and Virtual Surgery (ISMIVS),

As the COVID-19 pandemic continues to affect international travel, we've decided to postpone both the 5th Yangtze International Summit of Minimally Invasive and Noninvasive Medicine (ISMINIM) and the Re-election of Board Members of ISMIVS to 2022. The specific date of ISMINIM 2022 will be further discussed and announced.

Wish you all the best!
Sincerely Yours,

Prof. David Cranston
President, ISMIVS

尊敬的各位国际微无创医学会理事和会员，
由于新冠疫情持续影响国际旅行，我们决定将第五届国际微无创医学长江高峰论坛推迟到2022年举行。与此同时，国际微无创医学会理事会的改选也将推迟到峰会期间再举行。峰会召开的具体日期将再做商议并另行通知。

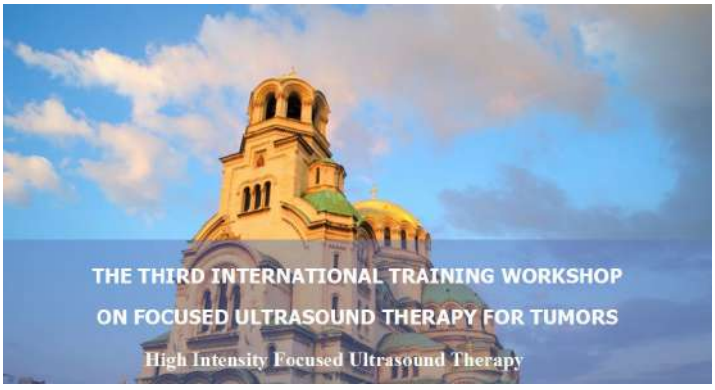
祝好！
谨上

David Cranston教授
国际微无创医学会主席

Please refer to Appendix 4 for past Yangtze Summits:

ISMINIM 2013, ISMINIM 2015, ISMINIM 2017 and ISMINIM 2019.

## 5.5 The Third International Training Workshop on Focused Ultrasound Therapy for Tumors (Bulgaria): Postponed to 2022




Due to restrictions of COVID-19 Pandemic on international travels, the Third International Training Workshop on Focused Ultrasound Therapy for Tumors (Bulgaria), originally planned in October, 2020, is now postponed to 2022. Specific schedule will hinge on the lift of travel restrictions. Please wait for future announcement.

Please refer to Appendix 5 for past international training workshops.

# VI. The Clinical Development of HIFU

In order to know the latest clinical development of high-intensity focused ultrasound ablation therapy, ISMIVS retrieved and analyzed HIFU literature published in 2019 and 2020 for your reference.

## 6.1 HIFU Literature Retrieval and Analysis: 2019-2020

A systematic electronic search was performed using the PubMed database for HIFU studies reported between January 2019 and December 2020. The electronic system was interrogated with the key words: high-intensity focused ultrasound. The following exclusion criteria were applied: 1. the research published in this area was not written in English; 2. the non-human treatment research, that is, the HIFU treatment was not performed in humans, such as animal research, pre-clinical research, simulation treatment or predictive analysis using a computer simulation model or phantom. The included studies consist of review articles and research articles. Statistics is made for the indications for HIFU treatment mentioned in the included studies. And statistics is also made for the number of treated cases with HIFU mentioned in the included research articles (including the number of cases treated with HIFU alone and that with HIFU combined other treatments).

HIFU Literature Analysis: 2019-2020

### 6.1.1.HIFU Literature Analysis: 2019

Date of Publication: Between January 2019 and December 2019

Key words: high-intensity focused ultrasound

375 articles were found using the PubMed database with the key words of high-intensity focused ultrasound. 249 articles were excluded. Among the 126 included articles, 38 indications were involved, including 7 indications in the OBGYN field.

### 6.1.2.HIFU Literature Analysis: 2020

Date of Publication: Between January 2020 and December 2020

Key words: high-intensity focused ultrasound

351 articles were found using the PubMed database with the key words of high-intensity focused ultrasound. 234 articles were excluded. Among the 117 included articles, 31 indications were involved, including 7 indications in the OBGYN field.

Indications Mentioned in HIFU Literature: 2019-2020

### 6.1.3.Indications Mentioned in the 2019 HIFU Literature

| Glaucoma | Thyroid nodules |
|---|---|
| Prostate cancer | Skin rejuvenation |
| Varicose veins and venous leg ulcers | Soft tissue sarcoma |
| Desmoid tumor | Breast fibroadenoma |
| Adenomyosis | Epilepsy |
| Endometriosis | Graves' disease |
| Uterine fibroid | Sacroiliac Joint |
| C-scar pregnancy | Psychiatric disorders |
| Cervical pregnancy | Movement disorder |
| Uterine arteriovenous malformation | Chronic pain |
| Twin-reversed arterial perfusion | Brain tumor |
| Pancreatic cancer | Benign prostatic hyperplasia |
| Tremor | Neuropathic pain |
| Parkinson's disease | Obsessive compulsive disorder |
| Allergic rhinitis | Facet joint osteoarthritis |
| Kidney tumor | Low-flow vascular malformations |
| Bone tumor | Pain management of osteoarthritis |
| retroperitoneal lymphatic metastases | Breast cancer |
| Liver tumor | Liver alveococcosis |

### 6.1.4.Indications Mentioned in the 2020 HIFU Literature

| Prostate cancer | Melasma |
|---|---|
| Thyroid nodules | Parkinson's disease |
| Mixed uterine fibroids and adenomyosis | Pancreatic cancer |
| Uterine fibroids | Removal of tattoo |
| Adenomyosis | Skin rejuvenation |
| C-scar pregnancy | Trigeminal Neuralgia |
| Endometriosis | Epilepsy |
| Placenta accreta | Perforating vein |
| Vulvar Lichen Sclerosus | Actinic keratosis |
| Abdominal Subcutaneous Fat Reduction | Basal cell carcinoma |
| Bone cancer | Kaposi sarcoma |
| Breast Cancer | Movement disorders |
| Liver tumor | Neurological disorders |
| Essential Tremor &Multiple Sclerosis | Brain tumors |
| Fibromatosis | Hilar Cholangiocarcinoma |
| Glaucoma | |

### 6.1.5.New Indications in 2020 compared to 201

| Vulvar Lichen Sclerosus | Removal of tattoo |
|---|---|
| Hilar Cholangiocarcinoma | Melasma |
| Perforating vein | Basal cell carcinoma |
| Actinic keratosis | Kaposi sarcoma |

Top 10 Indications with the Largest Number of Research Articles: 2019-2020

### 6.1.6.Top 10 indications with the Largest Number of Research Articles: 2019

| No. | Indication | Number of Research Articles | Total Number of Cases |
|---|---|---|---|
| 1 | Uterine fibroid | 22 | 2504 |
| 2 | Prostate cancer | 21 | 1059 |
| 3 | Pancreatic cancer | 6 | 523 |
| 4 | Bone tumor | 6 | 137 |
| 5 | Liver tumor | 6 | 347 |
| 6 | Tthyroid nodules | 6 | 499 |
| 7 | Adenomyosis | 4 | 1044 |
| 8 | Glaucoma | 4 | 91 |
| 9 | Endometriosis | 3 | 82 |
| 10 | Tremor | 3 | 8 |

### 6.1.7.Top 10 indications with the Largest Number of Research Articles: 2020

| No. | w | Number of Research Articles | Total Number of Cases |
|---|---|---|---|
| 1 | Uterine fibroids | 21 | 2667 |
| 2 | Prostate cancer | 22 | 5821 |
| 3 | Adenomyosis | 4 | 202 |
| 4 | C-scar pregnancy | 4 | 310 |
| 5 | Endometriosis | 4 | 36 |
| 6 | Thyroid nodules | 3 | 533 |
| 7 | Liver tumor | 3 | 101 |
| 8 | Glaucoma | 3 | 114 |
| 9 | Pancreatic cancer | 3 | 45 |
| 10 | Breast Cancer | 2 | 14 |

Number of Research Articles on HIFU for OBGYN Diseases: 2019-2020

### 6.1.8 Number of Research Articles on HIFU for OBGYN Diseases: 2019

| Indication | Number of Research Articles | Total Number of Cases | The Largest Number of Cases Mentioned | Article Information |
|---|---|---|---|---|
| Uterine fibroid | 22 | 2504 | 928 | Safety and Efficacy of Ultrasound-Guided High-Intensity Focused Ultrasound Treatment for Uterine Fibroids and Adenomyosis. Lee JS, Hong GY, Lee KH, Song JH, Kim TE. Ultrasound Med Biol. 2019 Dec;45(12):3214-3221. doi: 10.1016/j.ultrasmedbio.2019.08.022. Epub 2019 Sep 25. PMID: 31563479 |
| Adenomyosis | 4 | 1044 | 889 | |
| Abdominal wall endometriosis | 3 | 82 | 51 | Clinical analysis of high-intensity focussed ultrasound ablation for abdominal wallendometriosis: a 4-year experience at a specialty gynecological institution. Xiao-Ying Z, Hua D, Jin-Juan W, Ying-Shu G, Jiu-Mei C, Hong Y, Chun-Yi Z. Int J Hyperthermia. 2019;36(1):87-94. doi: 10.1080/02656736.2018.1534276. Epub 2018 Nov 14. |
| C-scar pregnancy | 2 | 222 | 154 | Outcomes of subsequent pregnancies in patients following treatment of cesarean scar pregnancy with high intensity focused ultrasound followed by ultrasound-guided dilation and curettage. Zhang C, Zhang Y, He J, Zhang L. Int J Hyperthermia. 2019;36(1):926-931. doi: 10.1080/02656736.2019.1654619. |
| Cervical pregnancy | 1 | 3 | 3 | The treatment of cervical pregnancy with high-intensity focused ultrasound followed by suction curettage: report of three cases Jianfa Jiang, Min Xue Int J Hyperthermia. 2019;36(1):273-276. PMID: 30676110 DOI: 10.1080/02656736.2018.1563914 |
| Uterine arteriovenous malformation | 1 | 1 | 1 | Ultrasound-guided high-intensity focused ultrasound as pretreatment before surgical excision for fertility-preserving management of uterine arteriovenous malformation Jia-Li Liu, Xiao-Ling Lin, Hong Zhou, Jing-Hua Pan, Gui-Hong Liu, Han-Lin Shuai, Xin-Luo Eur J Obstet Gynecol Reprod Biol. 2019 Sep;240:384-386. PMID: 31358399 DOI: 10.1016/j.ejogrb.2019.07.030 |
| Twin-reversed arterial perfusion sequence | 1 | 6 | 6 | Treatment of twin-reversed arterial perfusion sequence using high-intensity focused ultrasound. Seo K, Ichizuka K, Okai T, Dohi S, Nakamura M, Hasegawa J, Matsuoka R, Yoshizawa S, Umemura SI, Nagatsuka M, Sekizawa A. Ultrasound Obstet Gynecol. 2019 Jul;54(1):128-134. doi: 10.1002/uog.20101. PMID: 30136326 |

### 6.1.9.Number of Research Articles on HIFU for OBGYN Diseases: 2020

| Indication | Number of Research Articles | Total Number of Cases | The Largest Number of Cases Mentioned | Article Information |
|---|---|---|---|---|
| Uterine fibroids | 21 | 2667 | 508 | Non-contrast enhanced MRI for assessment of uterine fibroids' early response to ultrasound-guided high-intensity focused ultrasound thermal ablation. Liao D, Xiao Z, Lv F, Chen J, Qiu L. Eur J Radiol. 2020 Jan;122:108670. doi: 10.1016/j.ejrad.2019.108670. Epub 2019 Nov 10. PMID: 31778966 DOI: 10.1016/j.ejrad.2019.108670 |
| Adenomyosis | 4 | 323 | 202 | 500 Cases of High-intensity Focused Ultrasound (HIFU) Ablated Uterine Fibroids and Adenomyosis. (404 fibroids, 149 adenomyosis and 53 mixed conditions) Jeng CJ, Ou KY, Long CY, Chuang L, Ker CR. Taiwan J Obstet Gynecol. 2020 Nov;59(6):865-871. PMID: 33218403 doi: 10.1016/j.tjog.2020.09.013. |
| Cesarean scar pregnancy | 4 | 310 | 103 | Clinical outcome of high-intensity focused ultrasound as the preoperative management of cesarean scar pregnancy. Liu CN, Tang L, Sun Y, Liu YH, Yu HJ. Taiwan J Obstet Gynecol. 2020 May;59(3):387-391. doi: 10.1016/j.tjog.2020.03.009. PMID: 32416885 |
| Endometriosis | 4 | 36 | 20 | Transrectal high-intensity focused ultrasound (HIFU) for management of rectosigmoid deep infiltrating endometriosis: results of Phase-I clinical trial. Philip CA, Warembourg S, Dairien M, Lefevre C, Gelet A, Chavrier F, Guillen N, Tonoli H, Maissiat E, Lafon C, Dubernard G. Ultrasound Obstet Gynecol. 2020 Sep;56(3):431-442. doi: 10.1002/uog.21937. PMID: 31788875; PMCID: PMC7496183. |
| Placenta accreta | 1 | 63 | 63 | High-intensity focused ultrasound versus uterine artery embolization for patients with retained placenta accreta. Jiang J, Wang C, Xue M. Eur J Obstet Gynecol Reprod Biol. 2020 Sep;252:82-86. doi: 10.1016/j.ejogrb.2020.06.003. Epub 2020 Jun 8. PMID: 32590166 DOI: 10.1016/j.ejogrb.2020.06.003 |
| Mixed conditions: fibroid + adenomyosis | 1 | 53 | 53 | 500 Cases of High-intensity Focused Ultrasound (HIFU) Ablated Uterine Fibroids and Adenomyosis. (404 fibroids, 149 adenomyosis and 53 mixed conditions) Jeng CJ, Ou KY, Long CY, Chuang L, Ker CR. Taiwan J Obstet Gynecol. 2020 Nov;59(6):865-871. PMID: 33218403 doi: 10.1016/j.tjog.2020.09.013. |

Please see Appendix 6 for excerpts from selected articles

## 6.2 Clinical Application of HIFU in 2020

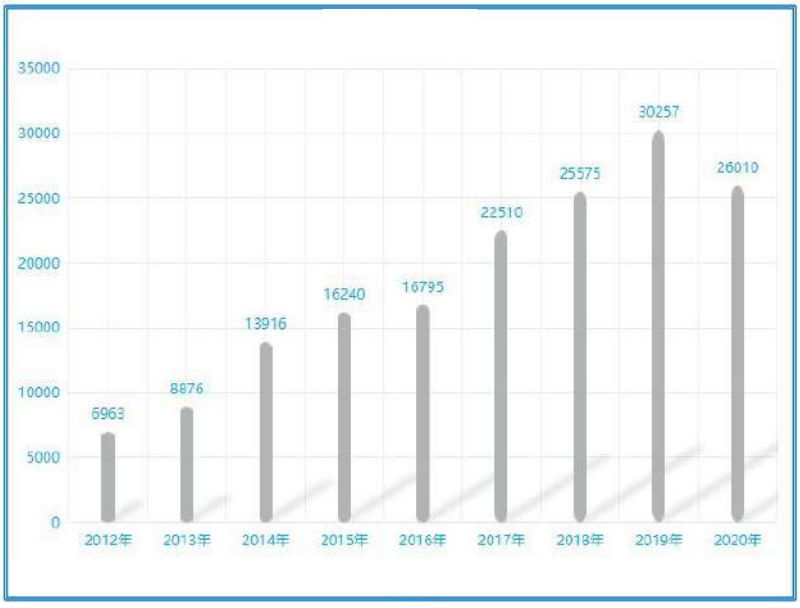
Focused ultrasound, which is undergoing a boom in basic research, clinical studies and clinical implementations, marks the start of the era of noninvasive medicine. High-intensity focused ultrasound (HIFU) ablation, in particular, has been increasingly applied in the treatment of a variety of tumors and disease conditions, and its clinical development has enjoyed steady progress.

In 2020, selective surgeries in hospitals around the world have been put off or canceled due to the COVID-19w pandemic. The number of HIFU ablation procedures performed has also been affected, but to a lesser degree. The difference can be ascribed by the unique advantages of HIFU ablation in treating benign gynecological diseases: performed as a day surgery procedure, no cutting-open, no bleeding, shorter hospital stay, and quicker recovery. HIFU ablation has gaining more and more recognitions by doctors and patients during the pandemic.

### 6.2.1.Clinical Data of HIFU Treatments

Global Big Data from National Engineering Research Center of Ultrasound Medicine (NERCUM)

The National Engineering Research Center of Ultrasound Medicine has counted the number of cases treated with ultrasound-guided HIFU in *235* clinical centers across *29 countries and regions*. By December 31st, 2020, the total number of treated cases between 2010 and 2020 has amounted to *175,769* in which *26010* cases were performed in the year of 2020.

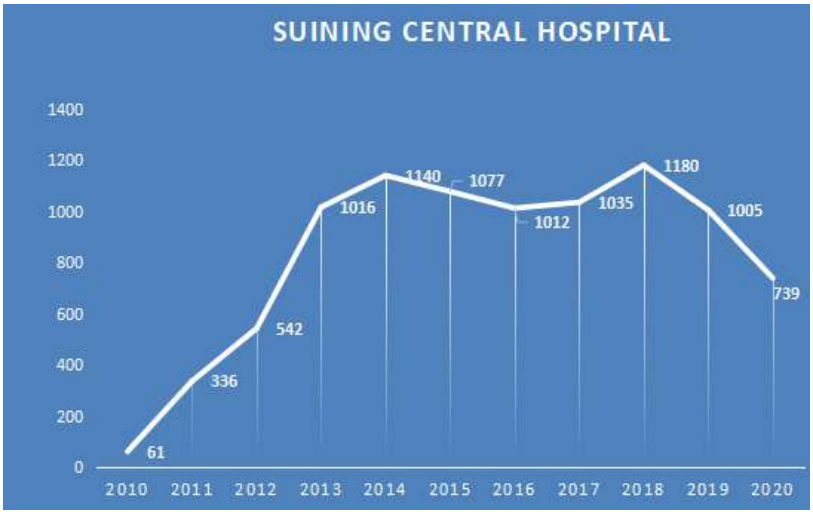



Number of USgHIFU Cases in 235 Clinical Centers

*Suining Central Hospital*, with *9,134 cases treated, ranks* the first in the world in terms of the number of cases treated with HIFU ablation; followed by *the Third Xiangya Hospital of Central South University* with *6,158 cases treated ranking the second and Chongqing Haifu Hospital with 6,032 cases treated* ranking the third.

### 6.2.2.Top Three Clinical Centers with the Largest Number of Cases Treated with HIFU in 2020

The top three clinical centers with the largest number of cases treated with HIFU in 2020 were *the Third Xiangya Hospital of Central South University (869 cases), Chongqing Haifu Hospital (763 cases ) and Suining Central Hospital ( 739 cases).*




Annual Numbers of USgHIFU Cases in Suining Central Hospital

**Suining Central Hospital** has started HIFU treatment service since 2010. By December 31st, 2020, it has performed *9,134* HIFU ablation procedures, ranking the first in the world in terms of the cumulative total number of HIFU cases. *11 indications* are in different stages of clinical research or being provided as paid medical treatments. The 11 Clinical Indications of HIFU Treatment and research at Suining Central Hospital:

*Gynaecology: uterine fibroids, adenomyosis, abdominal wall endometriosis, placenta accreta, cesarean scar pregnancy, dysfunctional endometrial hemorrhage*

*Surgery: fibroadenoma of breast, liver cancer, pancreatic cancer, bone tumors, soft tissue tumors*

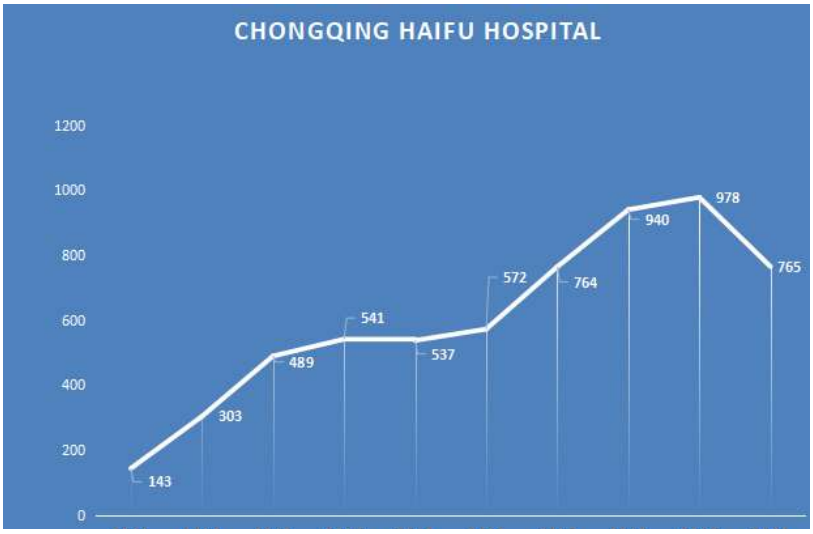

Annual Numbers of USgHIFU Cases in Third Xiangya Hospital of Central South University

**The Third Xiangya Hospital of Central South University** has started HIFU treatment service since April 24th, 2012. By December 31st, 2020, it has performed *6,158* cases with HIFU ablation (*869* cases in 2020), ranking the second in the world in terms of the cumulative total number of HIFU cases and the first in the world in terms of the number of HIFU procedures performed in 2020. 17 indications are in different stages of clinical research or being provided as paid medical treatments.

The 17 Clinical Indications of HIFU Treatment and research at the Third Xiangya Hospital of Central South University:

*Gynaecology: uterine fibroids, adenomyosis, caesarean scar pregnancy, placenta accreta, abdominal wall endometriosis, cervical pregnancy, intramural pregnancy, uterine arteriovenous fistula, cornual pregnancy, gestational trophoblastic tumors, diffuse myomatosis of uterus, granulosa cell tumors*

*Surgery: pancreatic cancer, liver cancer, abdominal wall metastatic tumors, retroperitoneal tumors*




Annual Numbers of USgHIFU Cases in Chongqing Haifu Hospital

**Chongqing Haifu Hospital** has started HIFU treatment service since 2011. By December 31st, 2020, it has performed *6,032* HIFU ablation procedures (763 cases in 2020), ranking the third in the world in terms of the cumulative total number of HIFU cases and the third in number of HIFU cases in 2020 alone. Now over *8* indications are in different stages of clinical research or being provided as paid medical treatments.

Clinical Indications of HIFU Treatment and research at Chongqing Haifu Hospital: *uterine fibroids, adenomyosis, abdominal wall endometriosis, placenta accreta, liver cancer, osteosarcoma, desmoid fibroma, breast fibroadenoma.*

### 6.2.3.Data from Clinical Centers Outside Mainland China:

The number of treated cases of *34* clinical centers from Hong Kong, China, Taiwan, China, South Korea and Singapore is *4169* in 2019 and *3692* in 2020. Now the clinical indications for HIFU treatment in the four regions are: *uterine fibroids, adenomyosis, placenta accreta, abdominal wall endometriosis, liver cancer, pancreatic cancer*, etc.

Taking the 21 clinical centers in South Korea for example, the number of cases treated with HIFU clinical treatment has been increasing steadily yearly from 2014 to 2020, growing slowly but steadily.


Annual Number of HIFU Cases in 21 Clinical Centers in South Korea

### 6.2.4.HIFU Training

According to the statistics from High-intensity Focused Ultrasound Tumor Treatment Training Base authorized by the Ministry of Health of China, *1,914 medical professionals* have received HIFU clinical training and *1,012 doctors have been certified to perform the ultrasound-guided HIFU procedure independently.*

From 2012 to 2019, the international training workshops organized by Chongqing Medical University has provided basic HIFU clinical training courses to *189 clinicians* from nearly 40 countries.

## 6.3 Indications that has been included into clinical guidelines or experts' consensus by the end of 2020

### 6.3.1.HIFU included into the 2020 Chinese Experts' Consensus on Diagnosis and Treatment of Adenomyosis


中华妇产科杂志

·专家共识·

子宫腺肌病诊治中国专家共识

中国医师协会妇产科医师分会子宫内膜异位症专业委员会

中华妇产科杂志, 2020,55(06) : 376-383. DOI: 10.3760/cma.j.cn112141-20200228-00150

摘要

子宫腺肌病是生育年龄妇女的常见病，其引起的月经过多、严重痛经和不孕对患者的身心健康造成严重的影响。本专家共识对子宫腺肌病的发病机制、临床表现、分型、诊断及影像学检查进行了系统描述和归纳，对子宫腺肌病的药物治疗、手术治疗、介入治疗进行了证据梳理并给出了推荐建议，也对子宫腺肌病合并不孕的治疗给予了专家建议和指导，对子宫腺肌病的长期管理诊疗流程提出了以证据为基础的专家共识性指导建议，均旨在为广大妇产科医师提供子宫腺肌病临床诊治的实用参考和专家指导。

引用本文：中国医师协会妇产科医师分会子宫内膜异位症专业委员会. 子宫腺肌病诊治中国专家共识 [J]. 中华妇产科杂志,2020,55(06):376-383. DOI: 10.3760/cma.j.cn112141-20200228-00150

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In June, 2020, the latest Chinese Experts' Consensus on Diagnosis and Treatment of Adenomyosis was published by the Special Committee of Endometriosis of the Chinese Obstetricians and Gynecologists Association (COGA) on the Chinese Journal of Obstetrics and Gynecology, introducing the high intensity focused ultrasound (HIFU) ablative therapy as one of the interventional therapies for adenomyosis as well as the indications, contraindications and complications for HIFU in the treatment of adenomyosis. Indications for HIFU include: 1) symptomatic adenomyosis; 2) the thickness of uterine wall at the lesion >3 cm; 3) premenopausal women; 4) the lesion can be clearly displayed and positioned by the ultrasound imaging and a safe acoustic pathway can be established; 5) patients that ask to receive HIFU therapy.

Read more >

## 6.3.2.2020 European Thyroid Association Clinical Practice Guideline for the Use of Image-Guided Ablation in Benign Thyroid Nodules

European Thyroid Journal

Guidelines

Eur Thyroid J 2020;9:172–185
DOI: 10.1159/000508484

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Accepted: May 7, 2020
Published online: June 8, 2020

# 2020 European Thyroid Association Clinical Practice Guideline for the Use of Image-Guided Ablation in Benign Thyroid Nodules

Enrico Papini[a] Hervé Monpeyssen[b] Andrea Frasoldati[c] Laszlo Hegedüs[d]

[a]Department of Endocrinology and Metabolism, Regina Apostolorum Hospital, Rome, Italy; [b]Thyroid Unit, American Hospital, Paris, France; [c]Department of Endocrinology and Metabolism, Arcispedale Santa Maria Nuova IRCCS-ASL, Reggio Emilia, Italy; [d]Department of Endocrinology and Metabolism, Odense University Hospital, Odense, Denmark

**Keywords**
Thyroid nodule · Thermoablation · Laser ablation · Radiofrequency · High-intensity focused ultrasound · Microwaves · European Thyroid Association

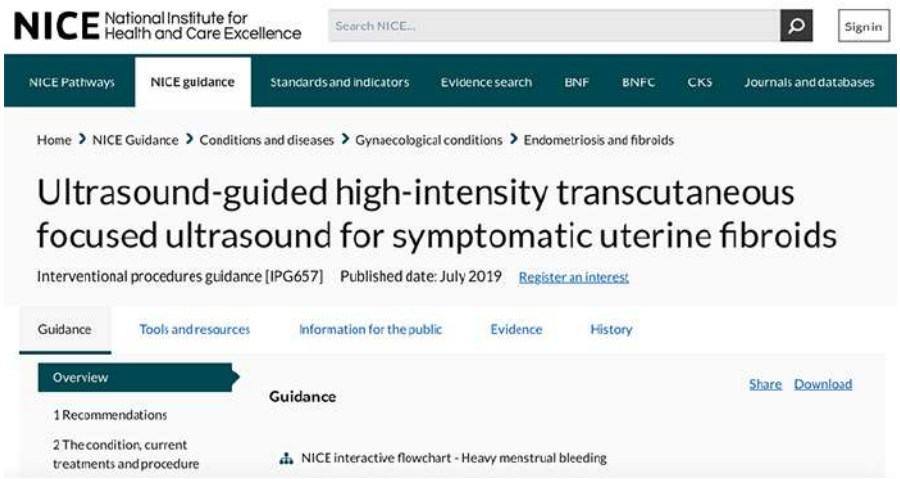
cystic nodules, ethanol ablation (EA) is the most effective and least expensive treatment. TA may be considered for cystic lesions that relapse after EA or have a significant residual solid component following drainage and EA. TA

In the guideline, it mentioned that presently, laser and radio frequency ablation are the most thoroughly assessed techniques, with similar satisfactory clinical results. Microwaves and high intensity focused ultrasound therapy options remain to be fully evaluated. HIFU procedure is performed in an outpatient setting, and treatment duration ranges from 40 to 60 min, but large-size (>5 cm) nodules usually require multiple treatments. In a 2017 review, the mean volume reduction after HIFU ranged from 48.8 to 68.8%. Similar results were obtained in 2 retrospective non-controlled studies reporting a 43% and a 70% volume decrease at 24-month follow-up. An inverse correlation between the initial nodule volume and the percentage shrinkage of

the lesion was reported, and a >50% volume decrease was seen only in small-size ( ⩽ 3.0 mL) nodules. No major complications, such as permanent recurrent laryngeal nerve palsy or skin burns, were reported in the above studies. Common side effects were pain, usually peri-thyroidal hematomas and skin burns were reported in 0.5% of patients. A single case of "nodule rupture" has been described but pseudocystic transformation and fasciitis represent more frequent complications and need to be better defined. Thyroid function appears unaffected by the HIFU treatment. In a retrospective non-randomized trial, HIFU treatment, as opposed to surgery, was associated with shorter hospital stay, lower cost and better post-procedural quality of the voice.

Read More >

### 6.3.3.NICE approved USgHIFU July 2019 Interventional Procedures Guidance IPG 657




On 24 July, 2019, the National Institute for Health and Care Excellence (NICE), UK, published guidance and evidence-based recommendations on ultrasound-guided high-intensity transcutaneous focused ultrasound for symptomatic uterine fibroids in adults.

Read More >

### 6.3.4.HIFU included into the FIGO Guidelines for Placenta Accreta


In 2018, the International Federation of Gynecology and Obstetrics (FIGO) published FIGO consensus guidelines on placenta accreta spectrum (PAS) disorders: Conservative management, consisting of the introduction to PAS disorders, epidemiology, prenatal diagnosis and screening, and conservative management for PAS disorders.

The 2018 FIGO Guidelines introduces a study on high-intensity focused ultrasound (HIFU) treatment of PAS disorders after vaginal delivery, which was led by Dr. Hongbo Qi from Department of Obstetrics and Gynecology, the First Affiliated Hospital of Chongqing Medical University, Chongqing, China. Entitled High-intensity focused ultrasound treatment of placenta accreta after vaginal delivery: a preliminary study, the study included 12 women with PAS disorders. The average period of residual placental involution was 36.9 days. HIFU treatment did not increase the risk of infection or hemorrhage and no patient required hysterectomy.

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## High-intensity focused ultrasound treatment of placenta accreta after vaginal delivery: a preliminary study

Y. Bai, X. Luo, Q. Li, N. Yin, X. Fu, H. Zhang, H. Qi

First published: 02 April 2015 | https://doi.org/10.1002/uog.14867 | Citations: 17

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### ABSTRACT

#### Objective

To evaluate the safety and efficiency of high-intensity focused ultrasound (HIFU) in the treatment of placenta accreta after vaginal delivery.

#### Methods

Enrolled into this study between September 2011 and September 2013 were 12 patients who had been diagnosed with placenta accreta following vaginal delivery and who had stable vital signs. All patients were treated using an ultrasound-guided HIFU treatment system. As indication of the effectiveness of the treatment we considered decreased

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## 6.3.5.HIFU included into the 2017 Chinese Expert Consensus on the Diagnosis and Treatment of Uterine Fibroids


In December, 2017, the latest Chinese Expert Consensus on the Diagnosis and Treatment of Uterine Fibroids was published by the Expert Panel on the Chinese Journal of Obstetrics and Gynecology, introducing the high intensity focused ultrasound ablation (HIFUA or ultrasound ablation) as one of the minimally-invasive and non-invasive surgeries or other treatment alternatives for uterine fibroids as well as the indications, contraindications and complications for HIFUA. Indications for HIFUA are largely the same as for open surgeries. However, HIFUA is recommended as the preferred choice for patients with desire of uterus-sparing, and for those who are intolerant of or unwilling to undergo open surgeries.

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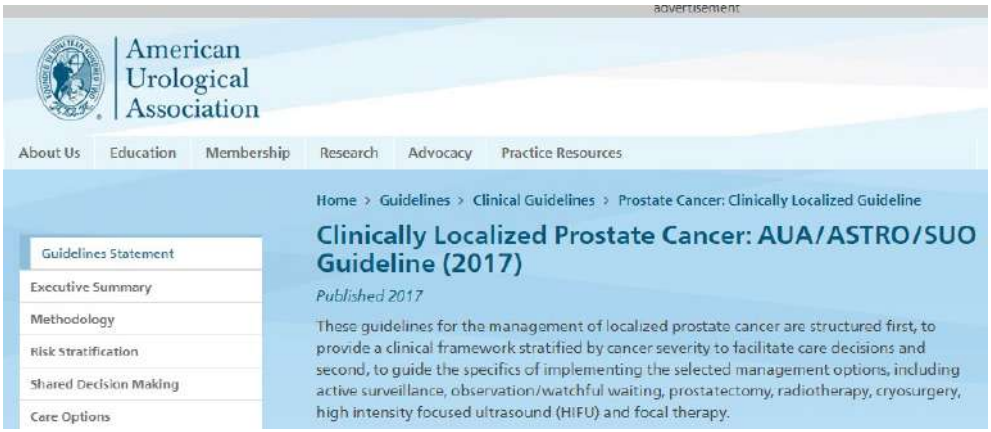
## 6.3.6.HIFU was included in Clinically Localized Prostate Cancer: AUA/ ASTRO/SUO Guideline (2017)




In this guideline, it is recommended by the experts that clinicians should inform low-risk and intermediate-risk patients who are considering focal therapy or HIFU that these interventions are not standard care options because comparative outcome evidence is lacking. Cryosurgery, focal therapy and HIFU treatments are not recommended for men with high-risk localized prostate cancer outside of a clinical trial. Clinicians should inform patients that these treatment options lack robust evidence of efficacy, even though HIFU is approved by the FDA for the destruction of prostate tissue, it is not approved explicitly for the treatment of prostate cancer. Tumor location may influence oncologic outcome. Limiting apical treatment to minimize morbidity increases the risk of cancer persistence. (Moderate Recommendation; Evidence Level: Grade C)

The Panel recommends that if HIFU is offered as an alternative treatment modality for localized prostate cancer, it should be done within the context of a clinical trial. Prospective randomized or comparative trials with other treatment modalities are lacking. Published five-year oncologic outcomes are variable and attributable to the lack of consensus on objective response criteria. However, it has been recognized that the PSA nadir level after whole gland HIFU is predictive of biochemical recurrence. The Panel awaits the results of well-designed comparative clinical trials in order to define the appropriate role of this technology in the management of localized prostate cancer. Whole prostate ablation utilizing HIFU with or without short term neoadjuvant ADT has been associated with a comparable incidence of post-treatment incontinence, bladder neck/urethral stricture, and rectourethral fistulae.

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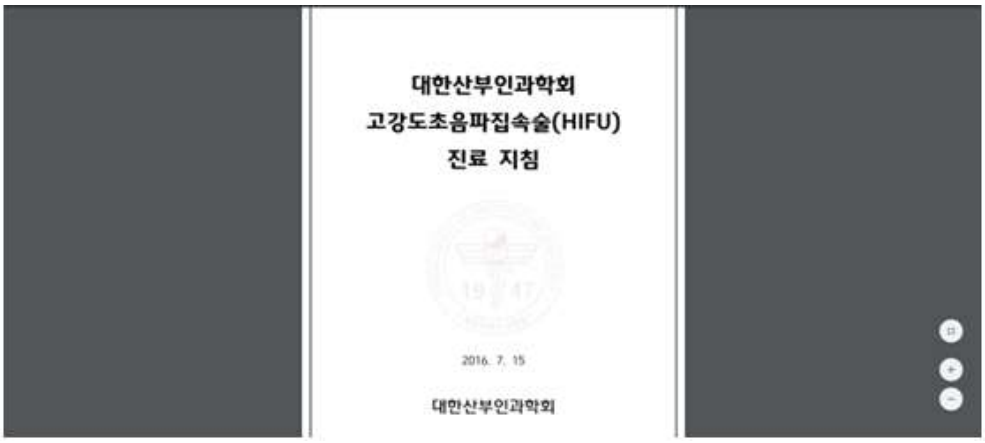
### 6.3.7.HIFU included into the KSOG Guidelines for uterine fibroids and adenomyosis



On July 15, 2016, the Korean Society of Obstetrics and Gynecology published medical guidelines on high-intensity focused ultrasound (HIFU), including MRI-Guided Focused Ultrasound Ablation and Ultrasound-guided High Intensity Focused Ultrasound. It specifies the key indications of HIFU: premenopausal patients of 18 years of age or older, with uterine fibroids or adenomyosis accompanied by symptoms such as hemorrhage, anemia and dysmenorrheal.

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### 6.3.8.HIFU included into the 2015 SOGC Clinical Practice Guideline for Uterine Leiomyomas


In February 2015, the Society of Obstetricians and Gynaecologists of Canada (SOGC) published SOGC Clinical Practice Guideline on the Management of Uterine Leiomyomas, introducing newer focused energy delivery methods, such as MR-guided focused ultrasound (MRg-FUS) or high frequency ultrasound-guided transcutaneous focused ultrasound ablation.

Case series for MRg-FUS ranging from 51 to 359 patients have been published and short-term efficacy is adequate, but complications such as skin burns have occurred in up to 7% of patients and at least one bowel perforation was reported. Disadvantages of the MRg-FUS system include high exclusion rate, requirement of an MR machine, prolonged time (minutes to several hours), treatment of 1 fibroid at a time, and ablation of fibroids centrally, while fibroids seem to grow peripherally.

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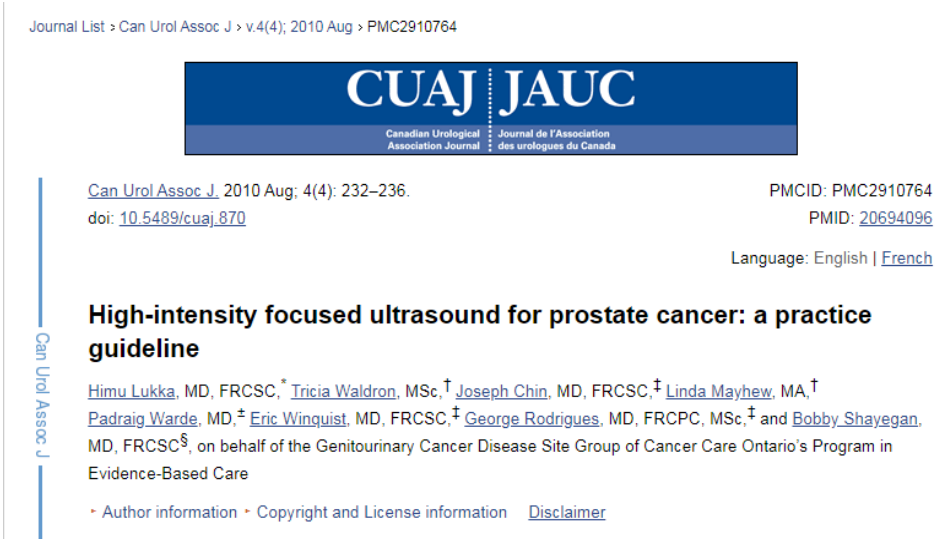
### 6.3.9.HIFU for prostate cancer: a practice guideline- the Genitourinary Cancer Disease Site Group of Cancer Care Ontario's Program in Evidence-Based Care, published in 2010



Journal List › Can Urol Assoc J › v.4(4); 2010 Aug › PMC2910764

CUAJ | JAUC

Canadian Urological Association Journal | Journal de l'Association des urologues du Canada

Can Urol Assoc J. 2010 Aug; 4(4): 232–236.
doi: 10.5489/cuaj.870

PMCID: PMC2910764
PMID: 20694096

Language: English | French

**High-intensity focused ultrasound for prostate cancer: a practice guideline**

Himu Lukka, MD, FRCSC,* Tricia Waldron, MSc,† Joseph Chin, MD, FRCSC,‡ Linda Mayhew, MA,† Padraig Warde, MD,‡ Eric Winquist, MD, FRCSC,‡ George Rodrigues, MD, FRCPC, MSc,‡ and Bobby Shayegan, MD, FRCSC§, on behalf of the Genitourinary Cancer Disease Site Group of Cancer Care Ontario's Program in Evidence-Based Care

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Can Urol Assoc J

Recommendation from the panel: HIFU cannot currently be recommended as an alternative to accepted curative treatment approaches for localized prostate cancer

The key evidences are as follows:

A systematic review of the literature was performed and showed there is currently no RCT evidence comparing the efficacy of HIFU with accepted

curative treatments for localized prostate cancer. The clinical evidence on HIFU is comprised of 34 case series (each containing a minimum of 50 patients). Twenty-three series were published as full reports and 11 were published in abstract form.

• Across the 34 studies of HIFU, the number of patients treated ranged from 50 to 1234 and totaled 7438 patients. However, owing to multiple counting of patients among series, it is difficult to estimate the true total number of patients treated with HIFU.

• Most patients treated had localized prostate cancer (stage T1-T2) and underwent HIFU because they were unsuitable or unwilling to undergo surgery. Over 90% of patients were treated as primary therapy, and less than 10% of patients were treated as salvage therapy following radiotherapy failure.

• The main outcomes reported in series were negative biopsy rates, prostate-specific antigen (PSA) levels (nadir, percent of patients with PSA ⩽ 0.5 ng/mL), disease-free survival rates and adverse effects.

• The definition of "disease-free" and the time point of measurement of this outcome varied significantly among series, making comparisons difficult. The most common definition included a positive biopsy and/or 3 consecutive PSA rises after the PSA nadir.

• Other outcomes relevant to this review, overall survival (1 series) and metastatic rate (no series), were not frequently reported.

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## 6.3.10.HIFU included into the 2008 ACOG Practice Bulletin for Leiomyomas


In August, 2008, the American College of Obstetricians and Gynecologists (ACOG) published the Practice Bulletin Number 96: Alternatives to Hysterectomy in the Management of Leiomyomas, introducing Magnetic Resonance Imaging-Guided Focused Ultrasound Surgery (MRIgFUS).

Outcomes of 109 patients were reported at 6 months and 12 months in two studies. Although only modest uterine volume reductions were noted (13.5% at 6 months and 9.4% at 12 months, using intention to treat analysis), 71% of patients reported symptom reduction at 6 months. At 12 months, 51% had symptom reduction. Adverse events included heavy menses, requiring transfusion (5); persistent pain and bleeding (1); hospitalization for nausea (1); and leg and buttock pain caused by sonification of the sciatic nerve in the far field (1), which eventually resolved. 3 case series suggest that improvement in symptoms at 12 months and 24 months is related to the thoroughness of treatment and that adverse events decrease with increasing experience. Whereas

short-term studies show safety and efficacy, long-term studies are needed to discern whether the minimally invasive advantage of MRI-guided focused ultrasound surgery will lead to durable results beyond 24 months. Protocols for treating larger leiomyoma volumes are being studied.

Read More>

## VII. Open Projects of Ultrasound Therapy Technology

As an exemplified technology of minimally invasive and non-invasive therapies, ultrasound therapy is deemed one of the frontiers in science and technology across the globe, and the exploration in minimally invasive or non-invasive therapies has become an inevitable trend of medical development in the 21st century. Universities and R&D institutions around the world have invested a lot of resources in the research and development of this technology. To facilitate the development of ultrasound therapy technology in the world and bring the mutual benefits to global research institutions, the State Key Laboratory of Ultrasound in Medicine and Engineering (SKLUME) in China opens some of their projects to seek global collaborations.

## 7.1 About State Key Laboratory of Ultrasound in Medicine and Engineering (SKLUME)

The State Key Laboratory of Ultrasound in Medicine and Engineering (SKLUME) was funded and set up in 2020 under the approval of the Ministry of Science and Technology of China and Chongqing Municipal Government. At present, it occupies 4,500 m2 of space, houses facilities of 60 million RMB and has more than 60 in-house staff members. Steered to the research in 1) macrosonics and the biological effect of high-energy acoustics, 2) multi-modality image monitoring and AI-aided precise therapy, and 3) clinical ultrasound therapy and big data, SKLUME has been studying high-energy acoustics and focused ultrasound surgery. On the yearly basis, SKLUME will open a certain number of projects for collaboration with domestic and overseas outstanding scholars. The open projects are included in the Chongqing Scientific Research Program and the support from the applicant institution with a matching fund (5 times of the fund provided by SKLUME) is required. In 2020, for example, SKLUME received 31 bids from 18 institutions, and 21 projects were finally approved, with a total of 6.042 million RMB provided by SKLUME.

## 7.2 The list of open projects of the SKLUME in 2020

| Serial No. | Title of Project&Applicant | Duration |
|---|---|---|
| 1 | Practical Clinical Study on the Pregnancy Outcomes of HIFU + GnRH-a Versus GnRH-a Alone for Adenomyosis Women with Fertility Needs<br>**The Third Xiangya Hospital of Central South University** | 2020.10-2022.9 |
| 2 | Clinical Efficacy of FUAS + Uterine Curettage Versus Uterine Curettage Alone for Type II Scar Pregnancy: A Randomized Controlled Study<br>**Qingdao Women and Children's Hospital** | 2020.10-2022.9 |
| 3 | Long and short-term Efficacy of HIFU for Uterine Fibroids Patients at Childbearing Age<br>**Nanchong Central Hospital** | 2021.1-2022.12 |
| 4 | HIFU followed by Oral Taking of Guizhi Fuling Capsules for the Treatment of Uterine Fibroids: A Multicenter Randomized Controlled Clinical Study<br>**Affiliated Hospital of Chengdu University of Traditional Chinese Medicine** | 2021.1-2022.12 |
| 5 | Perioperative Analgesic Efficacy of TCM for HIFU Treatment of Adenomyosis<br>**Affiliated Hospital of Chengdu University of Traditional Chinese Medicine** | 2021.1-2022.12 |
| 6 | Integrated Chinese and Western Medicine for the Management of Adenomyosis Patients post HIFU Therapy: A Real World Study<br>**Affiliated Hospital of Chengdu University of Traditional Chinese Medicine** | 2021.1-2022.12 |

| | | |
|---|---|---|
| 7 | Clinical Evaluation of the Impact of HIFU on the Ovarian Function of Uterine Fibroids Patients by AMH Measurement<br>**Lianyungang Maternal and Child Health Hospital** | 2021.1-2022.12 |
| 8 | The Role of MRI Typing in Evaluating the Efficacy of HIFU Therapy for Adenomyosis-related Dysmenorrhea<br>**Lianyungang Maternal and Child Health Hospital** | 2021.1-2022.12 |
| 9 | Mechanism and Prediction of Skin Injury Caused by FUAS Treatment of Uterine Fibroids<br>**Suining Central Hospital** | 2021.1-2022.12 |
| 10 | Pain-relief of Patients with Bone Metastasis of Lung Cancer Post High-Intensity Focused Ultrasound Therapy: A Single- center, Non-randomized, Parallel-controlled, Non-inferior Trial<br>**Suining Central Hospital** | 2021.1-2022.12 |
| 11 | Effect of HIFU treatment in Local Control of Breast Cancer after Neo-adjuvant Therapy and Its Impact on the Patient's Immune Status<br>**Suining Central Hospital** | 2021.1-2022.12 |
| 12 | Impact of FUAS on the Ovarian Function of Uterine Fibroid Patients at Childbearing Age: A randomized control study<br>**Liuzhou Maternity and Child Healthcare Hospital** | 2021.1-2022.12 |
| 13 | Comparison of the Efficacy of HIFU Therapy and Surgical Resection for Junction Resectable Pancreatic Cancer<br>**The Third Xiangya Hospital of Central South University** | 2021.1-2022.12 |
| 14 | HIFU Therapy + Drug Therapies for Uterine Adenomyosis: A Clinical Study<br>**Shenzhen Maternity and Child Healthcare Hospital** | 2021.1-2022.12 |
| 15 | Feasibility and Safety of FUS for Breast Cancer<br>**Mianyang Central Hospital** | 2021.1-2022.12 |

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| 16 | Combination of HIFU and Inhibitor of PD-1 for Treating Late-stage Liver Metastasis: Phase I/II Clinical Trial<br>**Mianyang Central Hospital** | 2021.1-2022.12 |
| 17 | Targeted Treatment Regimen of HIFU Therapy+ TBEA for Adenomyosis-associated Abnormal Uterine Bleeding: A Clinical Study<br>**Mianyang Central Hospital** | 2021.1-2022.12 |
| 18 | Feasibility and Safety of Focused Ultrasound Ablation of Late-stage Breast Cancer<br>**Mianyang Central Hospital** | 2021.1-2022.12 |
| 19 | Study of Focused Ultrasound Improvement of the Joint Dysfunction Caused by Knee Joint Injury<br>The First Affiliated Hospital of Chongqing Medical University | 2021.1-2022.12 |
| 20 | Study on the Medical Imaging Assessment of the Texture of Uterine Fibroids Treated by Focused Ultrasound Therapy<br>Zhongshan-Xuhui Hospital of Fudan University, Shanghai | 2021.1-2022.12 |
| 21 | Improvement of Qualify of Life of the Advanced Liver Cancer Patients treated by FUA combined with Traditional Chinese Medicine Scheme of Dialectical Treatment: A Clinical Study<br>Suining Central Hospital | 2021.1-2022.12 |

In 2021, SKLUME calls for the participation of international scholars and will open the research projects involving patients with the following FUS-target diseases as study subjects, including uterine fibroids, adenomyosis, chronic cervicitis and vulvar diseases, breast diseases, malignant tumors, chronic pain (of joints and soft tissues). The projects will cover studies on the decision-making and difficulties in clinical routine treatment of the target indications, the exploration of treatment scheme combining focused ultrasound with traditional Chinese medicine, the exploration of indications of ultrasound therapy and evaluation of treatment effectiveness, and the burden of diseases.

Should you be interested in the above projects, please inquire and join us:

Dr Li Faqi
Tele: +86-23-68485020
E-mail: lifq@cqmu.edu.cn

# VIII: New Developments in Minimally Invasive Laparoscopic and Hysteroscopic Gynecological Surgery :

Laparoscopy and hysteroscopy have been hailed as game changers in the treatment of gynecological diseases in 21st century. Gynecological endoscopy, a thriving technology, which can be used in both medical diagnosis and treatment of gynecological conditions, has attracted increasing attention.

Indications for gynecological endoscopic surgery include:

1. All kinds of ectopic pregnancy, and obstruction, distortion and adhesion of fallopian tubes;
2. Infertility, uterine perforation and migration of intrauterine contraceptive devices (IUDs);
3. Ovarian cysts, tumors, rupture of corpus luteum, polycystic ovary syndrome (PCOS);
4. Uterine fibroids, uterine prolapse, dysfunctional uterine bleeding;
5. Endometriosis, adenomyosis, chocolate cysts;
6. Pelvic inflammation and abscess;
7. Pre- and intraoperative diagnosis of chronic pelvic pain of unknown origin and mass of unknown nature, ovarian biopsy.

Source: https://baike.baidu.com/

The following is the highlight of the advancements in gynecological laparoscopy and hysteroscopy in the past two years, based on the latest literature and information released by major academic societies:

## 8.1 Major professional societies have released new guidelines/recommendations for gynecological laparoscopic and hysteroscopic surgery during COVID-19 outbreak.

A panel of experts from the European Society for Gynecological Endoscopy (ESGE) recommends that emergency surgery should be given priority during the pandemic and elective surgery be postponed. Consideration should be given to non-surgical alternatives when possible. It is necessary to screen patients for coronavirus infection before planned surgical treatment. If the patient is tested positive for Covid-19, surgery should be postponed until full recovery from Covid-19 infection. Measures should be taken to protect health care workers from contracting Covid-19. Laparoscopic surgery for gynecological emergencies and cancer would be beneficial for the health system by reducing hospital stay, compared to open surgery. However, this should be weighed against possible disadvantages of laparoscopic surgery during the outbreak.

**1st September 2020**

**Recommendations during COVID-19 outbreak**

ESGE Recommendations on Gynaecological Laparoscopic Surgery during COVID-19 outbreak

Global coronavirus pandemic has become the dominant issue throughout the world whilst the governments, nations and health services are trying to deal with its impact. Many countries are in either complete or partial lockdown to reduce the speed of transmission and save lives. Meanwhile healthcare systems are diverting their resources to looking after patients infected by the coronavirus. At the same time, women continue to present with gynaecological emergencies or are diagnosed with cancer treatment of which cannot be postponed. In order to guide our members and other colleagues organise their priorities and minimise the risk to themselves and their patients, the ESGE Executive Board has decided to release this statement.

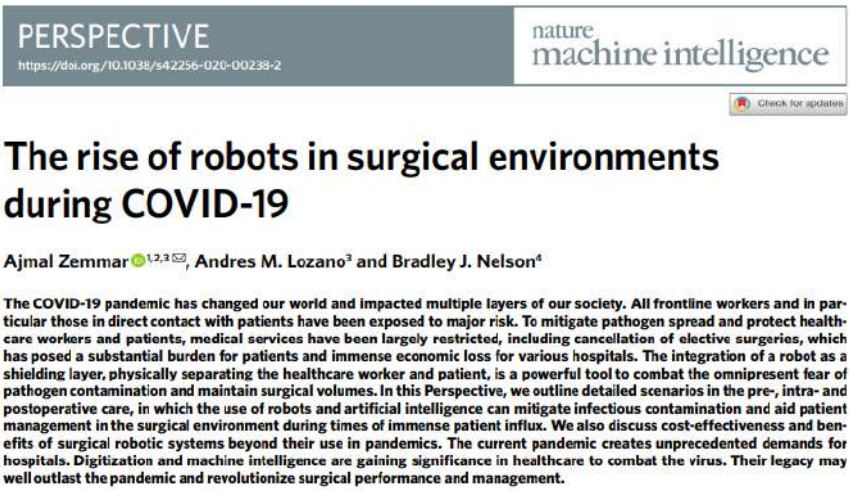
- During the time of crisis the healthcare providers need to be able to concentrate their resources on the care of people severely affected by the coronavirus, hence elective operations for benign conditions should not be carried out during the pandemic. When possible, alternative medical treatment approaches should be considered to minimise suffering and keep women at home, away from hospitals.
- Depending on the availability and priorities of the healthcare system, it would be useful to screen patients for corona virus infection before planned surgical treatment, when possible.
- In suspected or documented Covid-19 positive patients, surgery should be postponed until full recovery, if there is no immediate life threatening situation. Consideration should be given to non-surgical alternatives when possible. If this is not possible, surgery must be performed with full Personal Protective Equipment (PPE) worn by the entire theatre staff to reduce the risk of transmission.
- Hospitals should have arrangements in place to be able to look after women with gynaecological emergencies. Hospitals should also be able to care for women with possible gynaecological cancer and treat those who have been diagnosed with gynaecological cancer. Surgery for gynaecological cancer should continue, unless alternative interim options are possible until the end of the outbreak.
- Laparoscopic surgery for gynaecological emergencies and cancer would be beneficial for the health system by reducing hospital stay, compared to open surgery. However, this should be weighed against possible disadvantages of laparoscopic surgery during the outbreak

Source: https://esge.org/recommendations-during-covid-19-outbreak/

The American Association of Gynecologic Laparoscopists (AAGL) along with the American Urogynecologic Society, International Gynecologic Cancer Society, Society of Gynecologic Oncology and Society of Gynecologic Surgeons made the recommendation in a joint statement that nonessential surgical care should be suspended during the Covid-19 pandemic and if the surgery is essential, it should be carried out following amended treatment protocols under the pandemic. In addition, recommendations for best practice are listed when laparoscopy or robot-assisted laparoscopy is performed, such as:(1) Employ electrosurgical and ultrasonic devices in a manner that minimizes the production of plume, with low-power setting and avoiding long desiccation times. (2) A laparoscopic suction may be used to remove surgical plume and desufflate the abdominal cavity; do not vent pneumoperitoneum into the room., etc.


Source: https://www.jmig.org/article/S1553-4650(20)30250-8/fulltext

## 8.2 The constantly improved robot-assisted laparoscopy gains more recognition during COVID-19.



PERSPECTIVE
https://doi.org/10.1038/s42256-020-00238-2

nature machine intelligence

Check for updates

**The rise of robots in surgical environments during COVID-19**

Ajmal Zemmar[1,2,3], Andres M. Lozano[3] and Bradley J. Nelson[4]

**The COVID-19 pandemic has changed our world and impacted multiple layers of our society. All frontline workers and in particular those in direct contact with patients have been exposed to major risk. To mitigate pathogen spread and protect healthcare workers and patients, medical services have been largely restricted, including cancellation of elective surgeries, which has posed a substantial burden for patients and immense economic loss for various hospitals. The integration of a robot as a shielding layer, physically separating the healthcare worker and patient, is a powerful tool to combat the omnipresent fear of pathogen contamination and maintain surgical volumes. In this Perspective, we outline detailed scenarios in the pre-, intra- and postoperative care, in which the use of robots and artificial intelligence can mitigate infectious contamination and aid patient management in the surgical environment during times of immense patient influx. We also discuss cost-effectiveness and benefits of surgical robotic systems beyond their use in pandemics. The current pandemic creates unprecedented demands for hospitals. Digitization and machine intelligence are gaining significance in healthcare to combat the virus. Their legacy may well outlast the pandemic and revolutionize surgical performance and management.**

The article titled “The rise of robots in surgical environments during COVID-19” explores the rise of robot-assisted surgeries during Covid-19.

The current COVID-19 pandemic brings along several threats and restrictions to our society. A variety of potential implementations have been proposed to utilize robots in healthcare and beyond to face these challenges. AI and robotic technology can be utilized to face this challenge. Outside the operating room, these technologies can be implemented for various tasks such as digitized patient admission, effective triaging during times of high demand, acquisition and monitoring of vital signs, identification of high-risk nodes, sterilization with real-time contamination feedback, drawing of blood and delivery of food and drugs. In the operating theatre, robots can place intravascular lines, intubate the patient and manage the airway. For the surgical procedure itself, the smaller the number of the surgical team, the less the risk of contamination. While robot-assisted surgery can

reduce contamination risk, contactless remote robotic surgery would be the ideal scenario to prevent pathogen spread as it technically can be conducted with only the presence of the patient in the operating room. This visionary setting would allow continuing surgery during pandemics without risking increased contamination. Modelling studies based on accurate contact tracing in the operating room to compare detailed scenarios in the surgical environment with and without the use of robots would help to estimate the true benefit of robots in containing pathogen spread. Beyond the pandemic, use of these technologies in surgical environments can provide other benefits to improve safety and efficiency for the patient and to serve rural areas more effectively through remote surgery. Utilization of AI, virtual and augmented reality can help the surgeon to make the procedure safer, for example, by haptic feedback and projection of critical structures within the surgical field. Centralizing the assistive tools provided to the surgeon into a single component, for example, into a surgical glass, can simplify the application to the surgeon.

History shows that technology has advanced surgery more than any other field. Examples include the invention of imaging, the cautery, the microscope and many more. AI, machine learning and robotic technology may well be the next quantum leap."

Source: https://www.nature.com/articles/s42256-020-00238-2

## 8.3 The U.S. FDA issued Product Labeling for Laparoscopic Power Morcellators-Guidance: Perform Laparoscopic Power Morcellation only in Appropriately Selected Patients

US FDA published Product Labeling for Laparoscopic Power Morcellators-Guidance for Industry and Food and Drug Administration Staff: Perform Only Contained Morcellation When Laparoscopic Power Morcellation Is Appropriate: FDA Safety Communication

On December 29, 2020, the FDA issued the final guidance, Product Labeling for Laparoscopic Power Morcellators. The final guidance provides recommendations concerning the content and format for certain labeling information to better inform patients and health care providers of the device's risks. The FDA recommends performing laparoscopic power morcellation for myomectomy or hysterectomy only with a tissue containment system, legally marketed in the United States for use during laparoscopic power morcellation and performing these procedures only in appropriately selected patients.

Source: **https://www.fda.gov/medical-devices/safety-communications/update-perform-only-contained-morcellation-when-laparoscopic-power-morcellation-appropriate-fda**

## 8.4 The optimization of perioperative care and the long-term management of patients undergoing endoscopic surgery have attracted extensive attention from the academic community and will be a real challenge for minimally invasive surgery (MIS) in the coming decade.

Revolutionary perioperative treatment algorithms such as fast track and enhanced recovery after surgery (ERAS) have shown how much needs to be done around the operating room in order to optimize patient care. This gave rise to the rather puzzling situation of fewer complications and more favorable recovery in patients undergoing open surgery with optimized perioperative treatment compared to those who underwent minimally invasive surgery without an appropriate environment. Besides, it hindered the translation of reduced operative trauma into measurable patient outcome parameters such as the length of hospital stay or postoperative recovery in patients undergoing extensive cancer surgery, including esophageal resection. Again, it became clear that surgery is one instrument in the "concert" of patient care. No expert can play alone. This became even more evident after the advent of complex and highly successful medical cancer treatments with staged, perioperative, and truly multimodal treatment algorithms. The current task of oncologic surgery is no longer a "once in a lifetime" chance to "get rid" of the tumor. Rather, it is a module in modern cancer care that can be used repeatedly and also must be integrated into the mosaic of ongoing multidisciplinary treatment. This—together with the optimization of perioperative care—will be the true challenge of minimally invasive surgery in the coming decade.

Source: https://www.mdpi.com/2077-0383/10/1/131

In 2020, China issued a number of guidelines on the long-term disease management. Endometrial polyps have a high incidence and postoperative recurrence rate. Patients with fertility desire need to value antenatal care for a positive pregnancy, undergo a good long-term case management with timely detection and prevention of endometrial polyp recurrence. Hysteroscopy can detect adenomyosis in the early stage, which, without proper long-term management, will worsen as the endometrium gradually invades the myometrium and causes many other symptoms. Endometrial cancer is the most fatal disease, second to breast cancer. To prevent endometrial cancer, endometrial hyperplasia should not be ignored. It would be a lengthy process in which endometrial hyperplasia develop into precancerous lesions, so patients diagnosed with it need long-term hormone treatment to relieve symptoms and prevent recurrence and malignant progression. In this way the uterus and fertility could be saved. Scientific long-term or even lifelong management may reduce the incidence of endometrial cancer.

Source: **https://view.inews.qq.com/a/20210128A0BY8E00**

One of the hot spots in hysteroscopy in 2020 mentioned by Professor Xia Enlan, "Mother of Hysteroscopy", during an interview with obgyn.com

## 8.5 Further findings about the late complications of hysteroscopic surgeries

1) Placental diseases caused by intrauterine adhesion after hysteroscopic surgeries: In recent years, the incidence of placental accreta has been increasing, and many of the cases are caused by intrauterine adhesion after hysteroscopic operation. Studies show that placental accreta is related to the loss of decidua caused by intrauterine adhesion. In addition, pregnancy with intrauterine adhesion is also associated with adverse outcomes such as placenta previa, cervical pregnancy, residual placenta and arteriovenous fistula.

2) Obstetric uterine rupture after hysteroscopic surgeries: both China and other countries have reported uterine rupture during pregnancy after hysteroscopic electrotomy. Uterine rupture during pregnancy with or without uterine perforation during hysteroscopic surgery also occurs. The earliest rupture occurs at 19 weeks' gestation, and the latest one occurs during induced labor for full-term pregnancy. The types of surgery include hysteroscopic myomectomy, hysteroscopic metroplasty for uterine malformations, and hysteroscopic adhesiolysis.

3) Cervical insufficiency: the academia notices that dilation before hysteroscopic surgery may cause muscle fiber rupture at the internal cervical orifice, leading to cervical insufficiency. But based on the available data, there's still a lack of evidence to support the statement above.

Source: https://view.inews.qq.com/a/20210128A0BY8E00

One of the hot spots in hysteroscopy in 2020 mentioned by Professor Xia Enlan, "Mother of Hysteroscopy", during an interview with obgyn.com

## 8.6 With expanded indications, hysteroscopy is increasingly recognized by doctors.

As a safe and effective examination technique, cervical endoscopy can improve the diagnosis of cervical intraepithelial lesions and precisely locate lesions though dye test. It can avoid deep and wide excision from conization that might damage fertility. Cervical endoscopy is suitable for cases with the type 2 and type 3 transformation zone and suspected cases of high-risk groups of cervical cancer to check the cervical endometrial cavity. Now it is also applied in the treatment of cervical nabothian cyst, cervical polyps, cervical polypoid hyperplasia, abnormal vessels on the cervix, cervical fibroids, cesarean section scar diverticulum, cervical bleeding, cervical tears, a false passage in the cervical canal, etc., and the role of cervical endoscopy has gained increasing recognition from clinicians.

Source: https://view.inews.qq.com/a/20210128A0BY8E00

One of the hot spots in hysteroscopy in 2020 mentioned by Professor Xia Enlan, "Mother of Hysteroscopy", during an interview with obgyn.com

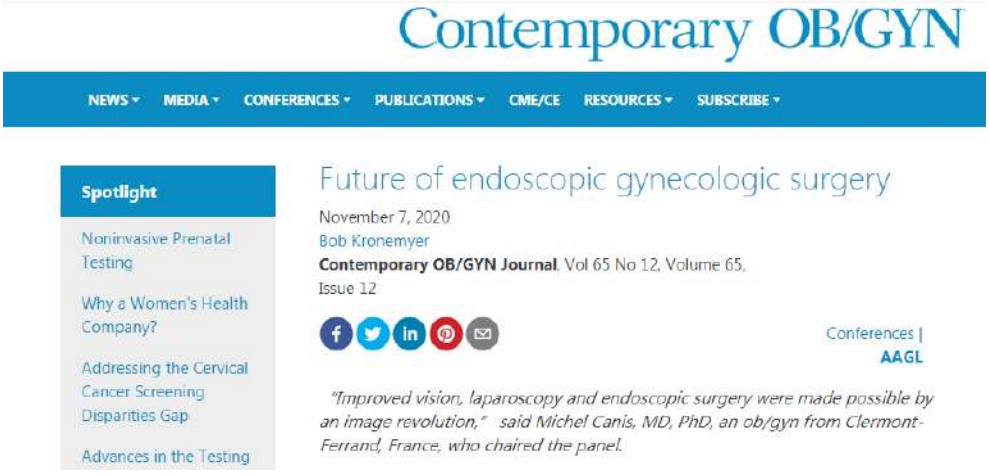
## 8.7 Hysteroscopy Endo-Operative System (HEOS) has returned to the public eye.

As early as 1986 and 1988, Professor Bao-Liang Lin from Japan and Professor Rafael F. Valle from the United States respectively applied HEOS to remove submucosal fibroids. Since the hysteroscopic electrotomy was invented in 1989, HEOS has been temporarily shelved. In recent years, this technology has returned to the public eye. Featuring a short learning curve, HEOS will not lead to complications caused by such energy-based medical instruments as high-frequency electricity or radio-frequency, nor carbonization of the cutting edge under energy effect that leads to tissue destruction, and it also will not affect pathological sampling. Some new HEOS products can be connected with monopole or bipolar wires to realize the shift between cold and hot resection without much worrying about bleeding. However, complicated cases such as large fibroids and other intrauterine mass lesions should still be managed with energy-based instruments and conventional technologies. Experts call on surgeons to use these two technologies properly, choose energy source according to the patient's condition, flexibly apply HEOS or hysteroscopic electrotomy,, give play to their respective advantages and perform effective hysteroscopic surgery with less bleeding in a short time.

Source: https://view.inews.qq.com/a/20210128A0BY8E00

One of the hot spots in hysteroscopy in 2020 mentioned by Professor Xia Enlan, "Mother of Hysteroscopy", during an interview with obgyn. com

## 8.8 A panel presentation proposes that augmented reality, a surgical black box, and tissue engineering are three technologies that bode well for the future of endoscopic gynecologic surgery.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Spotlight

Noninvasive Prenatal Testing

Why a Women's Health Company?

Addressing the Cervical Cancer Screening Disparities Gap

Advances in the Testing

Future of endoscopic gynecologic surgery

November 7, 2020
Bob Kronemyer
**Contemporary OB/GYN Journal**, Vol 65 No 12, Volume 65, Issue 12

Conferences | AAGL

*"Improved vision, laparoscopy and endoscopic surgery were made possible by an image revolution," said Michel Canis, MD, PhD, an ob/gyn from Clermont-Ferrand, France, who chaired the panel.*

According to a panel presentation at the American Association of Gynecologic Laparoscopists' (AAGL) 2020 Virtual Global Congress, augmented reality, a surgical black box, and tissue engineering are three technologies that bode well for the future of endoscopic gynecologic surgery.

Michel Canis, MD, PhD, an ob/gyn from Clermont-Ferrand, France who chaired the panel mentioned that new revolutions are coming using augmented reality and fluorescence, which will allow us to see structures which are not now visible. We will also be able to understand and to visualize intraoperative physiology -- an essential tool when deciding intraoperative management. Computer vision will be a major step forward. Together with fluorescence, augmented reality will revolutionize the world of surgery. On the other hand, a surgical black box will benefit the complex environment of an operating room (OR). "Analyzing this airline technology is something new for the

medical field," Dr. Canis said. "Studies clearly demonstrate that many events which can cause complications in the OR are not noticed by OR personnel, so the ability to analyze these at-risk events by using computers and artificial intelligence (AI) technology will improve our knowledge of what happens in the OR and our ability to improve outcomes, particularly when it comes to safety."

Tissue engineering is also expected to play a major role in the future, due to an aging population, for which reconstructive surgery such as prolapse surgery will become increasingly important. The ability to produce meshes with biologic components is of major significance for prolapse surgery because after surgery without meshes, "the risk of recurrence is close to 40%," Dr. Canis said.

Tissue-engineered technologies will also be used for adhesion prevention and for treating uterine synechia.

Source:

https://www.contemporaryobgyn.net/view/future-of-endoscopic-gynecologic-surger

# IX: Appendixes

## Appendix 1: Summary of 2020 Online Lectures by ISMIVS

### 1.1 SCGP-ISMIVS HIFU (ISH) Special Webinar 2020

Speakers were Professor Hervé Fernandez, President of SCGP and Director of Obstetrics and Gynecology, Bicetre; Professor Philippe Descamps, Vice President of SCGP, Executive Board Member of the International Federation of Gynecology and Obstetrics (FIGO) and Head of the Obstetrics and Gynecology Department at the University Hospital, Angers; Professor Gil Dubernard, SCGP Council Member, Director of the Obstetrics and Gynecology, Centre Hospitalier Lyon-Sud; Prof. David Cranston, President of ISMIVS, Associate Professor of Surgery in the Nuffield Department of Surgical Sciences in the University of Oxford and Clinical Director of the High Intensity Focused Ultrasound Unit in Oxford participated in this webinar.

Following Prof. Cranston's lecture on HIFU treatment for uterine fibroids in Oxford, Professor Fernandez pointed out that various articles and evidences showed that focused ultrasound ablation therapy in combination with other drugs had higher safety and effectiveness in treating some diseases. As a new non-invasive treatment option for uterine fibroids and adenomyosis, focused ultrasound ablation surgery shall be highly recommended in France.

Professor Descamps mentioned that SCGP was discussing with relevant French institutions to include focused ultrasound ablation therapy in the national medical insurance program, so as to better serve the patients. He also said that France had been left behind for 20 years in the application of focused ultrasound ablation technology, and now came

the time to fill this vacancy.

Professor Dubernard said that after learning the experience and achievements in performing HIFU therapy by Professor David Cranston at the University of Oxford in the UK, he was very optimistic about the introduction of focused ultrasound ablation therapy to France, and hoped this technology should be introduced as early as possible to serve French patients.

## 1.2 APAGE-ISMIVS HIFU （AIH） Webinar Series 2020

### 1.2.1 Episode 1

**Lecture 1:**

Speaker: Prof. Prashant Mangeshikar

Title: The skills at laparoscopic myomectomy-tips and tricks

-Good preceptorship, practice and hard work are needed to become a safe and skilled laparoscopic surgeon.

-The importance of LM include the knowledge of anatomy, instrumentation, techniques, difficulties, possible complication and limits. The key to good surgery is exposure.

-Does not believe in needing a bag for Laparoscopic Myomectomy because myomectomy in itself would have upstaged the Lelomyosarcoma.

-Risk of Leiomyosarcoma is very low and not about 1 in 350 mentioned by FDA.

-A statement from the Society of Gynaecologic Oncology, USA (Dec 2013)- " lelomyosarcomas offer an extremely poor prognosis even when the specimens are removed intact."

-Prof Prashant illustrates with his famous anology - "morsellating a

myoma in a bag" after removal is akin to "using a condom after sex".

- He also discourages the use of Ulipristal Acetate for the treatment of myomas after reports of liver impairments

(courtesy of Dr Lee Keen Whye for part of the summary)

**Lecture 2:**

Speaker: Dr Choi Dongseok

Title: Symptom score change & volume reduction of uterine fibroids with HIFU

Dr Choi started by sharing the HIFU case number done by him: 2125 cases in 4.5 years (Oct. 2015-May 2020). in 2013 KFDA approved USgHIFU for UF and KSOG included HIFU in their guideline in 2016. According to Dr. Choi's experience, non-perfused volume ratio more than 80% is recommended for achieving satisfactory volume reduction (40~60%) and lasting superior clinical symptom improvement (50~70% ) for 6 months. HIFU is a recognised safe and efficient technology in treating Uterine Fibroids with good results in symptom improvement, shrinkage of the uterus and quality of life. His choice of Ultrasound guided HIFU over MRIgHIFU was for its real time monitoring ability, ablation effectiveness and patient safety.

(courtesy of Dr Lee Keen Whye for part of the summary)

### 1.2.2 Episode 2

**Lecture 1:**

Speaker: Prof. Bernard Chern

Title: Uterine fibroids-when to operate and when not to operate

IM fibroid may be associated with lower fertility outcome

• Location, number, size may have a role

• Existing studies may have included submucous fibroids as intramural fibroids as TVUii1 HSG are used predominantly

No level I evidence that surgery improves fertility

Quite certain Surgery is associated with adverse fertility related complications

Associated with uterine rupture and increased neonatal morbidity and mortality

Consider surgery if

- Location - blocks ostia, endometrial encroachment, obstruct oocyte pickup
- Size And Number - cut off unclear (studies suggest between 2-5cm)
- Symptomatic

More studies are required, employing MRI/ Hysteroscopy /saline sonography for diagnosis in a well-designed adequately powered RCT

**Lecture 2:**

Speaker: Prof. Zhang Lian

Title: The Experience of HIFU with Uterine Fibroids in Chongqing-the birth place of US guided HIFU

The clinical study of USgHIFU for uterine fibroids started in 2000 and became clinical routine practice in 2005, the treatment for ademomyosis was in routine practice since 2007. A study which include 757 patients conducted by us showed that the symptom improvement was observed in 92.5% patients and the greatest improvement was seen 3 months after HIFU treatment. The volume of the treated fibroids at 3-,6-,12-,24-and 36- months decreased by 31.2%, 58.5%,70.3%,82.8% and 89.7% respectively.

### 1.2.3 Episode 3

**Lecture 1:**

Speaker: Dr S. Selva (Sevellaraja Supermaniam)

Title: Myomectomy and risk of uterine rupture in pregnancy: review of evidence between laparoscopic and abdominal approaches

Questions that are frequently asked

1. What is the difference between performing myomectomy laparoecopically compared to abdominally?

Currently doing in a more similar way, suturing with less use of diathermy, wood shall heal same as myomectomy

2. What is the risk of uterine rupture during pregnancy in general 1%

3. Is the Incidence of uterine rupture in pregnancy higher with laparoscopic myomectomy compared to abdominal myomectomy

Although it is not true by studies, but there is a tendency to be higher

4. What are the risk factors causing uterine rupture In pregnancy after myomectomy

We found no clear correlation between the risk for a uterine rupture and location of the fibroid and suturing techniques or whether the

operation was done in a university or a non-university hospital

5.Can we prevent uterine rupture in pregnancy after performing myomectomy?

Nothing we can do

6.How long after a myomectomy (laparoscopic or abdominal) is pregnancy safe?

Probably more than 3 months

**Lecture 2:**

Speaker: Prof. Felix Wong

Title: Focused Ultrasound Surgery (FUS) in Hong Kong and the potential of FUS development

HIFU is a new surgical direction, it's clinical advantages include: no bleeding, conservation of the uterus, the patient go home the next day or can even the same day for us in Hong Kong. Many comparative studies for HIFU vs Lap myomectomy shows HIFU is more effective, safer, quicker recovery, the ovary function and sexual function is better. Prof. Felix published an article in APAGE journal titled: Description of my HIFU center, in which he shared the facility and set-up of the HIFU center and his experience. From September 2020 to may 2021 Hong Kong experienced social unrest, COVID-19 but they never stopped doing HIFU. He mentioned the potential future of FUS in gynecology: 1. a unique noninvasive surgical approach; 2. reduces risks to doctors and patients from conventional surgical approaches; 3. need to improve the safety and efficacy of FUS--some methods have been taken to do so, such as the integration of MRI with ultrasound images, etc; 4. expand the uses in cancers, benign cysts and others; 5. and it can impact on environmental climate changes because HIFU cause little medical waste.

**Lecture 3:**

Speaker: Dr Raymond Setzen

Title: HIFU-clinical application in South Africa for Treatment of fibroids

Dr Setzen shared his experience of HIFU treatment in a large hospital located in Johannesburg serving mainly black people. He has treated 460 cases of uterine fibroids. The health economic benefits of HIFU: Reduce burden on health care system, including shorter stay in hospital, frees up theatres, lower running costs, decreases exposure to HIV, decreases dependence on blood. Benefits for patients: preserve the uterus-retain fertility; noninvasive so it can decrease recovery period, quicker return to work. The patients treated in his experience have higher weight (mean 79kg, range 43-115kg) and thicker abdominal wall(mean 49mm, range 33.3-64.7mm) comparing with other countries. The major adverse events are: 2 cases of 1st degree skin burns, 2 cases of nerve injury which revolved spontaneously and 1 case of rhabdomyolysis (underlying undiagnosied rapidly progressive glomerulonephritis, no bowel injury, no nerve injury. The Quality of life questionnaire shows that the average score increases from around 35 to almost 80 within 24 months after treatment, and for symptom severity score it dropped from 60 to below 20. The shrinkage rate found in follow up after 1,3,6 and 12 months are 31%, 52%, 61%, 73% respectively. Fertility success: 16 cases-8 currently pregnant, 1 vaginal delivery, 7 term Caesarean deliveries. Dr. Raymond concluded that HIFU is safe and effective alternative treatment for UF in black women, results promising, great potential for improving women's health, alleviates burden on his hospital.

### 1.2.4 Episode 4

HIFU-Spotlight on Adenomyosis& Infertility

**Lecture 1:**

Speaker: Dr. Olarik Musigavong

Title: Adenomyosis is: Tip of the iceberg of infertility

Dr. Olarik started his lecture by introducing different types of adenomyosis and the symptoms. According to a research, some 47% endometriosis patients suffered with painful sex. It also increase rate of spontaneous miscarriages. Adenomyosis will cause adverse perinatal outcomes, such as increased risk of second trimester miscarriage, preeclamsia and placental malposition. Current treatment methods are: expectant, medical treatment, surgery, UAE and HIFU. Based on his experience, for Infertility patient, integrative medicine shall be the solution, looking at the whole person instead of just the adenomyosis. The most important thing is the infertility treatment plan.

**Lecture 2:**

Speaker: Prof. Aixingzi Aili

Title: HIFU Experience from Shanghai First Maternity and infant Hospital, China

Prof. Aili from China first introduced her hospital and mentioned that the HIFU treatment cases in her hospital ranked 1st in Shanghai with 1550 cases accumulated from August 2015 to June 2020. Currently around 500 cases are done in her hospital every year. The main cases done are uterine fibroids and adenomyosis. Their research focuses on endometriosis and adenomyosis(AM). The category of adenomyosis type is very important for HIFU treatment. She shared their experience using combined therapy, i.e HIFU, GnRHa and LNG-IUS for the treatment of of AM. This therapy has been proved: it can lower the

risk of requiring hysterectomy; it is safe, effective and efficiency; it can improve quality of life, especially for patients with localized adenomyosis.

### 1.3.ISMIVS joined ASFMS Academy Webinar

**Lecture 1:**

Speaker: Prof. Samir Elsayed

Topic: Thyriod Gland Disorders in Reproduction

Prof. Elsayed shared his experience on the management of thyriod gland disorders in reproduction. His take-home-messages are: 1) One third of sub-fertile patients have thyroid disease; 2) Normal TSH levels are the pre-requisite requirements for fertilization; 3) Administration of L-thyroxine may be considered in sub-clinically hypothyroid women who are attempting natural conception; 4) In case the woman is not pregnant following controlled ovarian stimulation, serum TSH measurements should be repeated in 2-4 weeks because levels may normalize; 5) In management of hyperthyroidism with pregnancy use the lowest dose of ATD; 6) In management of hypothyroidism with pregnancy, maintain the target TSH levels < 2.5 mIU/L in 1st trimester and < 3 mIU/L in the 2nd & 3rd trimester.

**Lecture 2:**

Speaker: Prof. Aboubakr Elnashar

Title: Antenatal Management of Singleton Pregnancies Conceived Using Assisted Reproductive Technology (ART)

Prof Elnashar's view: 1) While most assisted conceptions have a normal course, not all do. 2) Singleton pregnancies resulting from ART are at increased risk of maternal and fetal complications, many of which may be under- or over appreciated. 3) Understand the potential risks, their

significance and how best to monitor them. 4) An awareness of these risks is required, and assisted conceptions should be managed in the same way as spontaneous pregnancies. 5) A thorough risk assessment is imperative, since many women undergoing ART have additional risk factors that warrant increased monitoring.

**Lecture 3:**

Speaker: Dr. Jordi Rodriguez

Title: HIFU and Infertility

Dr. Rodriguez introduced the relationship between uterine fibroids and infertility. Current treatment options for uterine fibroids include excisional procedures and non-surgical ablation procedures. He shared his HIFU experience in the University Hospital Mutua de Terrassa (HUMT), Barcelona, Spain where he works: totally 684 patients received HIFU treatments, of which 68% had successful results and the rest needed surgical procedures. The adverse event rate was 10%, which were mainly first- or second-degree skin burns (38%), hematuria (35%), vaginal bleeding (14%), etc. Pregnancy outcomes: 71 pregnancies (55 women), 43 live births (61%), of which 24 were vaginal deliveries (56%). No uterine rupture or placenta accreta was found in the 55 patients.

**Lecture 4:**

Speaker: Dr. Mervat Sheta

Topic: Pelvic Disorders

Incidence of pelvic disorders in Egypt is not clear. More than 80% of pelvic floor disorders can be treated successfully with pelvic floor rehabilitation. Since 2000, conservative management has been implemented as first-line therapy. It is a minimally invasive, simple and cost-effective approach with limited unfavorable physical side-effects. Before rehabilitation program, the pelvic floor muscle shall be assessed. Patient's lifestyle change can help. There are several trainings can be

taken: Biofeedback pelvic floor training, electrotherapy--transcutaneous electrical nerve stimulations (TENS), posterior tibial nerve stimulation (PTNS), electromagnetic stimulation etc. Her take-home message is that pelvic floor rehabilitation can open hidden closed doors, so ask the patients don't suffer in silence.

**Lecture 5**:

Speaker: Dr. Sahar Abdulghani

Topic: Ultrasound in Emergency

Principles to follow: 1.Understand when to perform a trans-vaginal versus a trans-abdominal ultrasound exam. 2.Understand the importance of probe orientation. 3.Understand the steps to performing a systematic gynecological ultrasound examination. 4.Understand how to accurately assess the pelvis during an ultrasound examination.

Follow the ISUOG recommendations to do general checklist for basic gynecological ultrasound scan. Gynecological emergencies are sub-divided into different categories. Different diagnosis varies & overlaps, a quick review is needed during image reading to exclude co-existent disease.

The key points are: 1. Know the normal anatomy/pathology. 2. Use systematic scanning technique. 3. Know knobology well to optimize your image. 4. Use previous images for correlation.

**Lecture 1:**

Speaker: Dr. Ichnandy A. Rachman

Topic: General Treatment Modalities for Fibroids

For the management of fibroids, there are surgical management such as hysteroscopic myomectomy, laparoscopy myomectomy and non-surgical alternatives such as medical therapy, UAE and HIFU. Dr. Rachman introduced the indications of different treatment options and advantages of endoscopic myomectomy. Studies have shown that laparoscopic myomectomy appears to offer a number of advantages if the myoma is not larger than 10 cm; that it is a safe and reliable procedure in the presence of multiple or enlarged myomas; and that it can be performed by experienced surgeons regardless of the size, number or location of the myomas. He believed that the next step of surgery would be noninvasive surgery such as HIFU. He concluded that: 1) The management was only for symptomatic fibroids; 2) For infertility patient: embolization, LNG-IUS were not options; 3) Minimally invasive surgery should be chosen if the medical therapy was not responding; 4) There are other options varying from classic laparoscopy to less scar surgery, no scar surgery and noninvasive surgery in fibroid management.

**Lecture 2:**

Speaker: Prof. Lian Zhang

Topic: The Experience of HIFU for Uterine Fibroids in Chongqing

Prof. Lian Zhang first introduced the working principles and development history of HIFU. The clinical indications for HIFU include uterine fibroids, adenomyosis, liver tumor, pancreatic cancer, etc. There are two types of HIFU systems, one is guided by ultrasound and the other by MRI and Prof. Zhang has experience in using both systems. The advantages of MRIgHIFU are better anatomic resolution and

temperature sensitivity, while USgHIFU has advantages in transducer movement, patient positioning, treatment time, treatment efficiency and cost. MRgHIFU is commonly operated by radiologists while USgHIFU is operated by gynecologists. The first fibroid patient was treated by Prof. Zhang's team using USgHIFU in 2000. A study which enrolled 757 patients with 1,114 uterine fibroids (2006-2009) showed that the non-perfused volume (NPV) of the fibroids after treatment reached to 84.8%, and symptom improvement was observed in 92.5% of patients. The volume of treated fibroids at 3-, 6-, 12-, 24- and 36-months decreased by 31.2%, 58.5%, 70.3%, 82.8% and 89.7% respectively. The recurrent rate after HIFU was comparable to myomectomy if NPV reached 80% or above.

**Lecture 3:**

Speaker: Dr. Relly Y. Primariawan

Topic: Adenomyosis and Infertility

Adenomyosis may cause fertility outcome decrease due to impairment of sperm transport by aberrant uterine contractility and also impairment of embryo implantation by disturbance milieu of endometrium. Studies have showed that the effect of focal adenomyosis favors diffused adenomyosis on IVF outcome. Current surgical techniques of adenomyosis include invasive surgery (open/laparotomy), minimally invasive surgery and noninvasive surgery. Not clear enough -> surgical intervention for adenomyosis could improve fertility outcome; two studies comparing a combined treatment with use of conservative surgery & GnRH-a vs GnRH-a treatment alone showed the surgery was associated with increased pregnancy rate. New modality treatment is required for adenomyosis to improve fertility outcome.

**Lecture 4:**

Speaker: Prof. Aixingzi Aili

Topic: HIFU Experience in Shanghai First Maternity and Infant Hospital, China

Prof. Aili from China first introduced her hospital. She mentioned that the number of HIFU treatment cases in her hospital ranked 1st in Shanghai with 1700 cases accumulated from August 2015 to September 2020, involving such indications as adenomyosis, uterine fibroids, cesarean scar pregnancy, placenta accreta, and abdominal wall endometriosis. An IDEAL prospective exploration study concluded that HIFU caused substantially less morbidity than surgery, with similar longer-term QoL. Studies have also showed that HIFU combined with hysteroscopic resection for the treatment of placenta accreta is safe and effective; either HIFU or surgery is safe and effective in treating patients with abdominal wall endometriosis, but HIFU has the advantages of shorter hospital stay, no blood loss, no scar, no anaesthesia and a lower immediate pain score. Besides, Prof. Aili also shared her combined therapy of HIFU, GnRH-a and LNG-IUS for the treatment of adenomyosis. Such combined therapy has been proved safe, effective and efficient, which can lower the risk of requiring hysterectomy and improve patients' quality of life, especially for those with localized adenomyosis.

# Apendix 2: Summary of 2020 Online Lectures by Other Societies Engaged in Minimally Invasive and Noninvasive Medicine

## 2.1.PSGE Webinar: Myoma Uteri: Options in Management


https://youtu.be/8cHANGOEqk0

Philippine Society for Gynecologic Endoscopy (PSGE) convened a live webinar on August 5, 2020, focusing on the minimally invasive and noninvasive techniques for the management of uterine fibroids. Dr. LEE Keen Whye, a founding member of the Asia-Pacific Association for Gynecologic Endoscopy and Minimally Invasive Therapy (APAGE), was invited to share his view on and experience in non-invasive high intensity focused ultrasound (HIFU) ablation of uterine fibroids. In his opinion, from minimally invasive surgery to noninvasive surgery, HIFU is revolutionary and disruptive.

For the playback of the webinar, please click the link below:

## 2.2.The 8th Sino-European Gynecological Endoscopy Summit: Conference of ESGE in Asia-Pacific Region


To promote the development of minimally invasive surgeries and facilitate the pround communiction among medical professionals, the 8th Sino-European Gynecological Endoscopy Summit: Conference of ESGE in Asia-Pacific Region held by the First Affiliated Hospital of Sun Yat-sen University is taking place from August 27 to October 30, 2020. Due to the ongoing COVID-19 pandemic, this conference takes place both online and offline. Lectures by speakers of different places are delivered at where the speakers are and broadcasted live through Internet. About 200 experts from China and abroad are discussing current hot and difficult issues in gynecological endoscopic surgeries and tumor therapies and doing surgery demonstration.

Prof. Hugo C. Verhoeven, Medical Director of Private Center of Reproductive Medicine, Endocrinology, Genetics and Anti-Aging Medicine in Dusseldorf, Germany, gave a lecture on non-surgical ablative therapy of adenomyosis on September 22. For the playback of Prof. Verhoeven's speech, please click the link below:

Playback link of Prof. Verhoeven's speech:

https://youtu.be/gPuptz-vYfE

## 2.3.MOGS Virtual Conference Conflict to Clarity: Focus on Controversial Gynecological Issues


At the invitation of the Mumbai Obstetric & Gynecological Society (MOGS), Prof.Rudy Leon De Wilde, Chief Medical Officer of the Pius-Hospital, Medical Campus University Oldenburg, Germany and Director and Past President of European Society for Gynaecological Endoscopy (ESGE), and Prof. Hugo C. Verhoeven, Medical Director at the Private Center for Reproductive Medicine, Endocrinology, Genetics and Anti-Aging Medicine in Dusseldorf, Germany and Chair of ESGE Working Group on Non-surgical ablative therapy of benign uterine disease, introduced high-intensity focused ultrasound (HIFU) as a non-surgical ablative therapy of adenomyois on August 30, 2020. It was a MOGS Virtual Conference on the theme of Conflict to Clarity: Focus on Controversial Gynecological Issues.

For the playback of the speeches, please click the link below:

https://www.youtube.com/watch?v=6PH3Epy5nBw

## 2.4.Nigerian Webinar 2020: Recent Advancements in Endometriosis Diagnosis and Management


On October 10, 2020, focusing on the recent advancements in endometriosis diagnosis and management, the Society of Gynaecology and Obstetrics of Nigeria (SOGON) in conjunction with the African Endometriosis Awareness and Support Foundation invited six doctors from five countries to share their clinical experience and research results on the webinar, among whom Dr. ZHANG Lian, Professor of Chongqing Medical University, China, Secretary-General of the International Society of Minimally Invasive and Virtual Surgery (ISMIVS), introduced noninvasive high-intensity focused ultrasound (HIFU) in the management of endometriosis.

Dr. Zhang has performed successful HIFU ablation of adenomyosis, bladder endometriosis, abdominal wall endometriosis and other benign uterine diseases as well as malignant tumors. One of the adenomyosis patients got pregnant 2 months after HIFU treatment and induced abortion and conceived again at 4 months later with full-term

pregnancy. HIFU is confirmed in China a safe and effective technique for the treatment of certain types of endometriosis.

Dr. Francisco Carmona from Spain gave the evidence of causal relationship between endometriosis and female infertility and concluded that removal of lesions is beneficial for improving fertility.

Dr. Abayomi Ajayi from Nigeria confirmed in his lecture that IVF can be used in all stages of endometriosis preferably as the first option and 6-12 months after surgery.

Dr. Olarik Musigavong from Thailand introduced the management of endometriomas. Different techniques including excision, bipolar coagulation, or CO2 ablation, etc. are recommended.

For the playback of the webinar, please click the link below:

https://youtu.be/Y4rPvQ2PwCM

## 2.5.2020 TAMIG Annual Conference

The Taiwan Association for Minimally Invasive Gynecology (TAMIG) held its annual conference between Oct. 31 and Nov. 1, 2020 and introduced the topic of noninvasive HIFU ablation of tumors.

Prof. YING Tsung-Ho, Associate Professor of Department of Medicine of Chung Shan Medical University, was invited to share his five years of HIFU experience in Chung Shan Medical University Hospital. Prof. Ying is proficient in obstetrics and gynecology, perinatal medicine, high-risk pregnancy, laparoscopic surgery and HIFU therapy.

Prof. LEE Keen Whye, Founding Member of the Aia-Pacific Association for Gynecologic Endoscopy and Minimally Invasive Therapy (APAGE), was invited to give his outlook on HIFU therapy, "From Minimally Invasive Surgery to Non-invasive Surgery, HIFU is Revolutionary and Disruptive".

For more information about the conference, please visit the website of TAMIG: www.tamig.org

For the playback of the webinar, please click the link below:

https://youtu.be/USQVwDDTkEE

## 2.6.Debate: vaginal myomectomy VS HIFU for fibroids

On the call of the Vice President of Mumbai Obstetric & Gynecological Society, a unique and inspiring debate on the management of uterine fibroids by vaginal myomectomy or HIFU ablation was held on November 11, 2020.

Dr. Ichnandy A. Rachman from Indonesia, Vice Secretary General of the Asia-Pacific Association for Gynecologic Endoscopy and Minimally Invasive Therapey (APAGE) and President of Indonesian executive board on German Indonesian Society of Minimal Access Surgery, played a video of vaginal myomectomy to show its advantages. The use of the vaginal route for endoscopic procedures started from 1901 for ventroscopy and was extended to fertiloscopy until 1998. Transvaginal endoscopy (TVE) and fertiloscopy is the only vaginal NOTES in office setting. Transvaginal endoscopy incorporates the advantages of vaginal procedures and single port laparoscopy, and therefore broadens the indications for vaginal procedures and avoids adbominal wall wounds and trocar-related complications while giving more ergonomic position for the surgeon. When performing TVE, the surgeon can sit down at ease. If the surgeons already manage the skills of laparoscopic surgery, it would be very easy for them to master vaginal NOTES. In addition, no extra equipment but a wound retractor is needed, and therefore the cost is low.

Dr. Sevellaraja Supermaniam from Malaysia, Past President of APAGE, introduced and commented on ultrasound-guided HIFU ablation of uterine fibroids. Ultrasound-guided HIFU ablation is a noninvasive treatment to preserve the integrity of organs without bleeding or incision. It is precise and does not require general anesthesia and sterilization of operating theater. The procedure is comfortable and relaxing. And the patient can resume normal activities in 1 or 2 days after treatment. The procedure can be finished within one or two hours by either a gynecologist or a trained doctor.

For the playback of the webinar, please click the link below:

https://youtu.be/6iiGj0AmrCk

## 2.7.ESGE HIFU SYMPOSIUM：TREATMENT OF SYMPTOMATIC MYOMATA WITHOUT MEDICATION OR SURGERY: A RISING PHOENIX ?


The online ESGE HIFU symposium was held on the 8th of December, 2020, drawing attention of many international OBGYNs. It was co-chaired by Prof. Rudy Leon De Wilde, Past President of European Society for Gynaecological Endoscopy (ESGE) and Prof. David Cranston, President ISMIVS.

To start with, Prof. Hugo C. Verhoeven, Chair of ESGE Working Group on Non-surgical ablative therapy of benign uterine disease, shared his understanding of HIFU with the participants. From his perspective, HIFU is a non-invasive technology that provides a possible alternative or complement to surgery, radiation, medication, and cancer therapy. He also introduced the two major advantages of HIFU ablation with the audience, namely, its clinical advantages and social advantages.

Dr. LEE Keen Whye, a founding member of the Asia-Pacific Association for Gynecologic Endoscopy and Minimally Invasive Therapy (APAGE), also offered the audience valuable insights into this new technology. In his speech, he sent a clear message to the world that by using HIFU

technology to treat a disease like symptomatic myoma, we need less endovision camera systems and blood transfusions. And at the same time, we can have a better deployment of medical resources such as operation rooms and nurses for other types of surgeries, representing a positive cost saving to the hospitals.

For the playback of the webinar, please click the link below:

https://youtu.be/8ikWu5qi7fU

## 2.8.Emergency and Innovative Medicine Summit Forum

The Emergency and Innovative Medicine Summit Forum during 2020 Beijing International Health Industry Expo was successfully held on the afternoon of December 12, 2020 in China International Exhibition Center, Beijing, China. It was co-organized by the Chinese Association for Promoting UN Procurement and Beijing Huatong Guokang Foundation with the support of the United Nations Development Programme (UNDP) and the Global Health Forum of Boao Forum for Asia. Over 100 United Nations officials, World Health Organization officials and Presidents of Chinese hospitals attended this forum.

Prof. David Cranston, University of Oxford, President ISMIVS and Curator of 13 Norham Gardens and Osler's Library Oxford, was invited to deliver a speech entitled From William Osler's Medical Philosophy to the Guiding Principles of Minimally Invasive and Noninvasive Surgery. Via a video recorded for this Forum, Prof. David Cranston gave a brief introduction to Sir William Osler and his legacy to medicine as well as the clinical research and application of Oxford University in the field of high intensity focused ultrasound (HIFU) in the past two decades for uterine fibroids, liver and kidney tumors, sacral chordomas, targeted drug delivery, etc.

Here are some Osler Quotes:

1. Soap and water and common sense are the best disinfectants.
2. Diseases that harm require treatments that harm less.
3. Medicine is learned by the bedside and not in the classroom.
4. The good physician treats the disease, but the great physician treats the patient who has the disease.
5. It is much simpler to buy books than to read them and easier to read them than to absorb their contents.
6. He who studies medicine without books sails an uncharted sea, but he

who studies medicine without patients does not go to sea at all.

7. Care more for the individual patient than for the special features of the disease. Put yourself in his place, the kindly word, the cheerful greeting, the sympathetic look — these the patient understands.

8. A physician who treats himself has a fool for a patient.

9. Start at once a bedside library and spend the last half hour of the day in communion with the saints of humanity.

10. The young doctor should look about early for a pastime, that will take him away from patients, pills, and potions.

11. We are here to add what we can to life, not to get what we can from it.

12. The first duties of the physician is to educate the masses not to take medicine.

13. The young physician starts life with 20 drugs for each disease, and the old physician ends life with one drug for 20 diseases.

14. The practice of medicine is an art, not a trade; a calling, not a business; a calling in which your heart will be exercised equally with your head.

15. The philosophies of one age have become the absurdities of the next, and the foolishness of yesterday has become the wisdom of tomorrow.

For the playback of the webinar, please click the link below:

https://youtu.be/bexiqn3MX-c

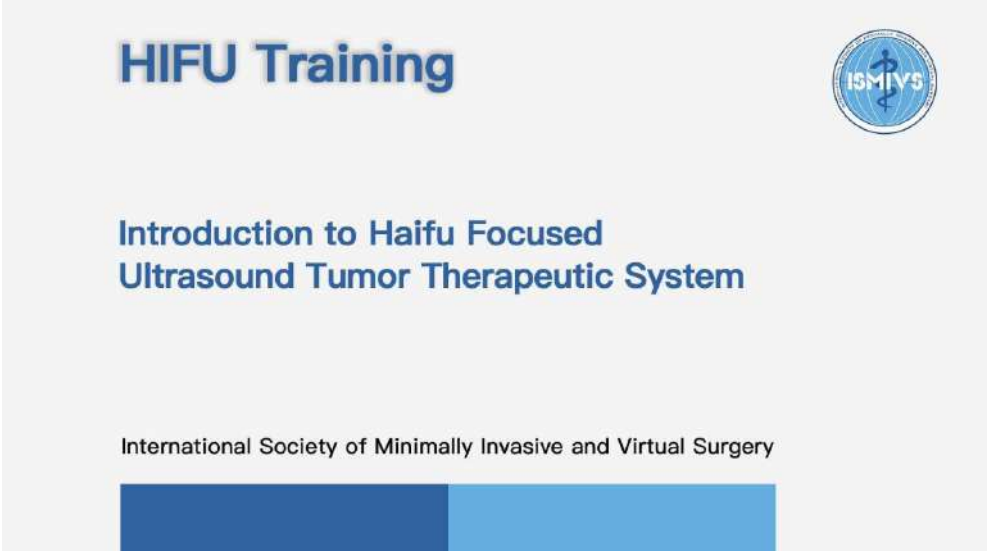
# Appendix 3: HIFU Training Courses by ISMIVS

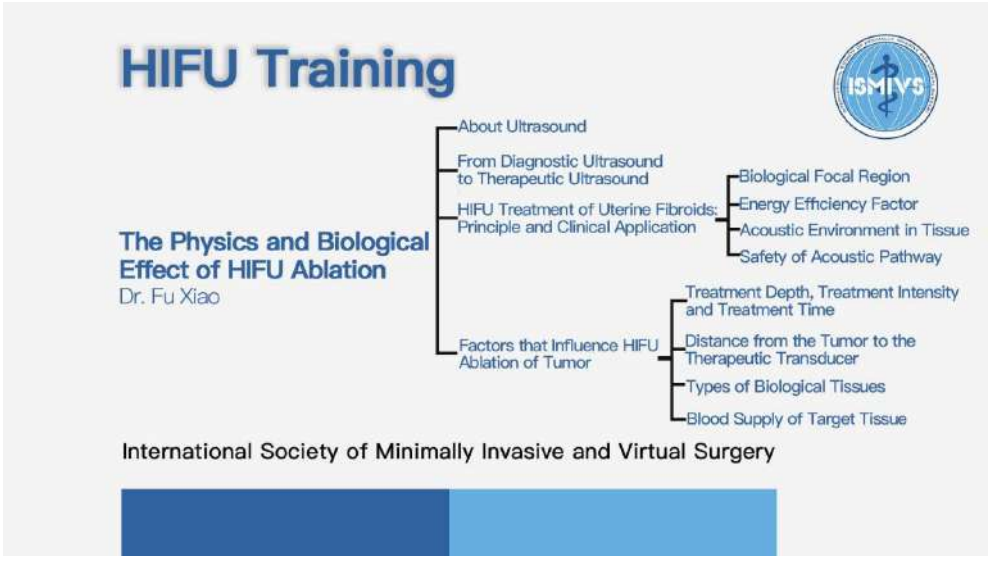
Please see below the mindmaps for each course.

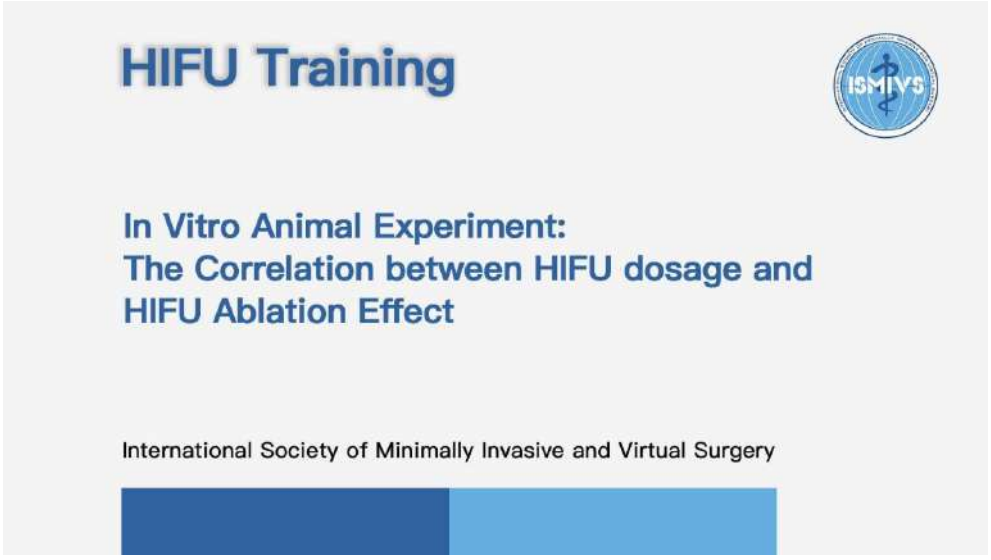
HIFU training course that have been available online:

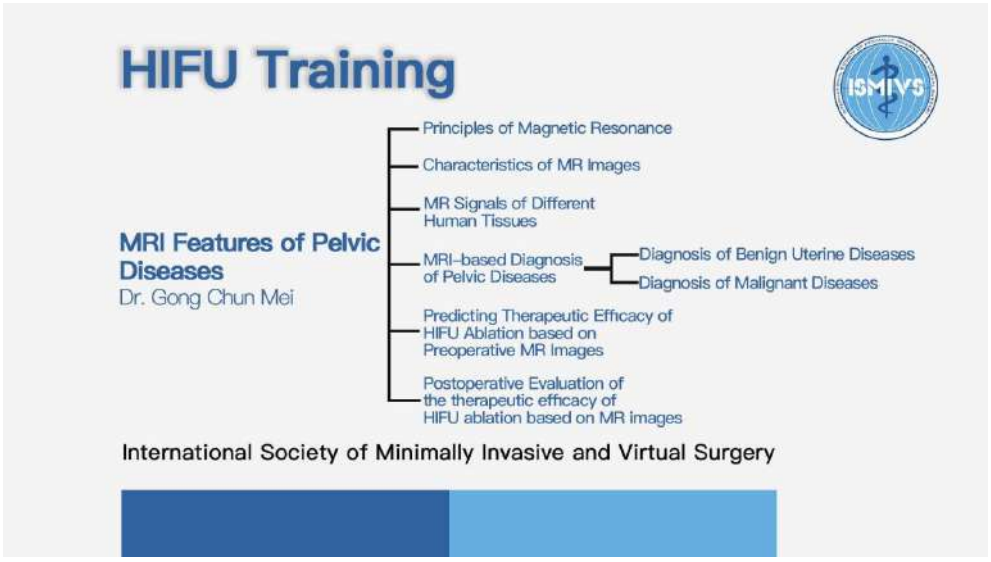
1. Introduction to Haifu Focused Ultrasound Tumor Therapeutic System
2. The Physics and Biological Effect of HIFU Ablation
3. In Vitro Animal Experiment: The Correlation between HIFU dosage and HIFU Ablation Effect
4. MRI Features of Pelvic Diseases
5. Techniques for Understanding MR Images and Its Clinical Application in HIFU Ablation
6. HIFU Treatment of Uterine Fibroids: Clinical Protocol
7. Case Study on HIFU Ablation of Uterine Fibroids

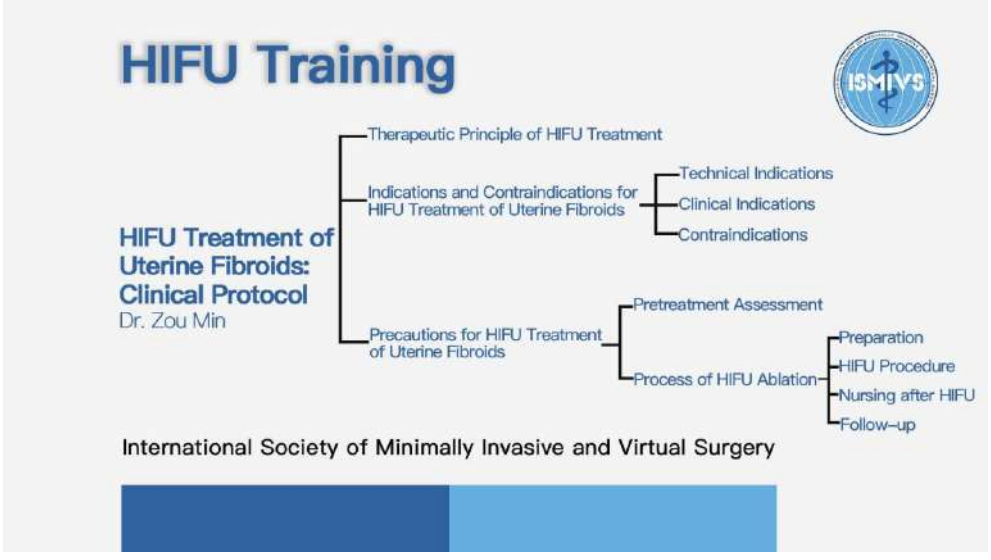
Sedation and Analgesia Planning for HIFU Ablation




HIFU Training
The Physics and Biological Effect of HIFU Ablation
Dr. Fu Xiao
About Ultrasound
From Diagnostic Ultrasound to Therapeutic Ultrasound
HIFU Treatment of Uterine Fibroids: Principle and Clinical Application
Biological Focal Region
Energy Efficiency Factor
Acoustic Environment in Tissue
Safety of Acoustic Pathway
Factors that Influence HIFU Ablation of Tumor
Treatment Depth, Treatment Intensity and Treatment Time
Distance from the Tumor to the Therapeutic Transducer
Types of Biological Tissues
Blood Supply of Target Tissue
International Society of Minimally Invasive and Virtual Surgery


HIFU Training
In Vitro Animal Experiment:
The Correlation between HIFU dosage and HIFU Ablation Effect
International Society of Minimally Invasive and Virtual Surgery


HIFU Training
ISMIVS
MRI Features of Pelvic Diseases
Dr. Gong Chun Mei
Principles of Magnetic Resonance
Characteristics of MR Images
MR Signals of Different Human Tissues
MRI-based Diagnosis of Pelvic Diseases
Diagnosis of Benign Uterine Diseases
Diagnosis of Malignant Diseases
Predicting Therapeutic Efficacy of HIFU Ablation based on Preoperative MR Images
Postoperative Evaluation of the therapeutic efficacy of HIFU ablation based on MR images
International Society of Minimally Invasive and Virtual Surgery


HIFU Training
ISMIVS
HIFU Treatment of Uterine Fibroids: Clinical Protocol
Dr. Zou Min
Therapeutic Principle of HIFU Treatment
Indications and Contraindications for HIFU Treatment of Uterine Fibroids
Technical Indications
Clinical Indications
Contraindications
Precautions for HIFU Treatment of Uterine Fibroids
Pretreatment Assessment
Process of HIFU Ablation
Preparation
HIFU Procedure
Nursing after HIFU
Follow-up
International Society of Minimally Invasive and Virtual Surgery

# HIFU Training

## Case Study on HIFU Ablation of Uterine Fibroids

International Society of Minimally Invasive and Virtual Surgery

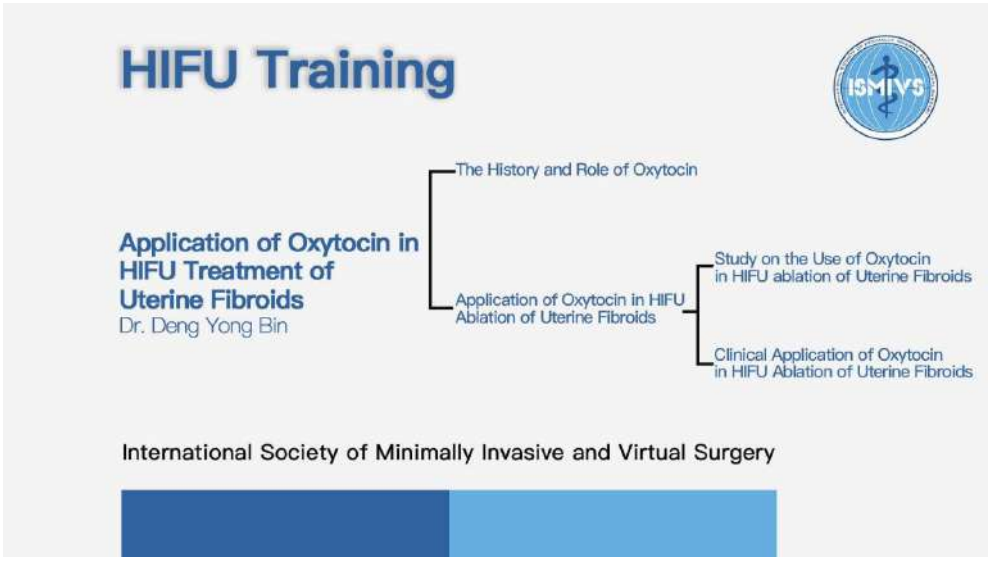
# HIFU Training

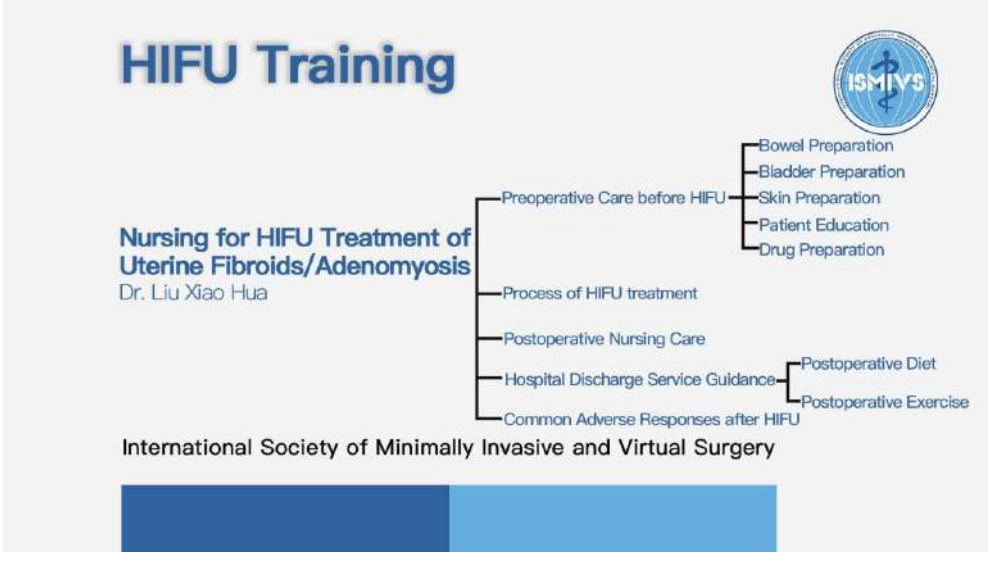
## Sedation and Analgesia Planning for HIFU Ablation

Dr. Fu Xiao

- Sedation and Analgesia in HIFU Ablation
- Preoperative Preparation for Sedation and Analgesia
  - Patient Preparation
  - Drug Preparation
  - Device Preparation
- Intra-operative Sedation and Analgesia Regimen
- Risks and Complications of Sedation and Analgesia: Management and Prevention

International Society of Minimally Invasive and Virtual Surgery

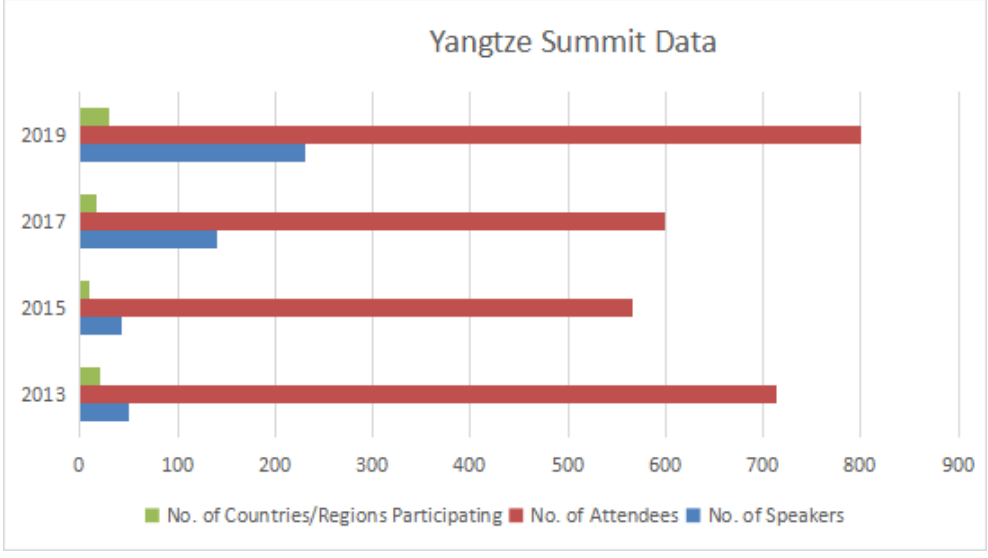

HIFU Training
ISMIVS
Application of Oxytocin in HIFU Treatment of Uterine Fibroids
Dr. Deng Yong Bin
The History and Role of Oxytocin
Application of Oxytocin in HIFU Ablation of Uterine Fibroids
Study on the Use of Oxytocin in HIFU ablation of Uterine Fibroids
Clinical Application of Oxytocin in HIFU Ablation of Uterine Fibroids
International Society of Minimally Invasive and Virtual Surgery


HIFU Training
ISMIVS
Nursing for HIFU Treatment of Uterine Fibroids/Adenomyosis
Dr. Liu Xiao Hua
Preoperative Care before HIFU
Bowel Preparation
Bladder Preparation
Skin Preparation
Patient Education
Drug Preparation
Process of HIFU treatment
Postoperative Nursing Care
Hospital Discharge Service Guidance
Postoperative Diet
Postoperative Exercise
Common Adverse Responses after HIFU
International Society of Minimally Invasive and Virtual Surgery

# Appendix 4: About Yangtze International Summit of Minimally Invasive and Noninvasive Medicine

The Yangtze International Summit of Minimally Invasive and Noninvasive Medicine is a significant academic event of ISMIVS for sharing progresses made in the burgeoning field of minimally invasive and noninvasive medicine. It is held biennially in Chongqing, China. Since 2015, Yangtze Summit has been held together with the Annual Meeting of the Minimally-invasive and Noninvasive Medicine Committee of Chinese Medical Doctor Association (MINIC of CMDA).

| Yangtze Summit Data | | | |
|---|---|---|---|
| Year | No. of Speakers | No. of Attendees | No. of Countries/Regions Participating |
| 2013 | 50 | 713 | 20 |
| 2015 | 43 | 566 | 10 |
| 2017 | 140 | 600 | 16 |
| 2019 | 231 | 800 | 29 |



ISMINIM 2013

ISMINIM 2015

ISMINIM 2017

ISMINIM 2019

## Appendix 5: About International Training Workshop on Focused Ultrasound Therapy for Tumors

The International Training Workshop on Focused Ultrasound Therapy for Tumors is a medical training program sponsored by Chinese government, provides training courses on High Intensity Focused Ultrasound (HIFU) therapy for clinicians including obstetricians and gynecologists, oncologists, surgeons, interventional radiologists, etc. Since 2012, under the auspices of the Department of International Cooperation, Ministry of Science and Technology of the People's Republic of China, it has been implemented for 7 sessions by Chongqing Medical University and National Engineering Research Center of Ultrasound Medicine jointly with different organizations, having trained 149 doctors from 42 countries. Since 2018, Chongqing Medical University has worked with ISMIVS to bring this Workshop to other countries. The first stop was Cairo, Egypt in 2018 and the second stop was Johannesburg, South Africa in 2019. The third overseas Workshop was planned to be held in Pleven, Bulgaria in 2020, but was postponed due to COVID-19.

The 2019 International Training Workshop on Focused Ultrasound Therapy for Tumors in South Africa

The 2-week Workshop involved 22 clinicians from 13 countries, including South Africa, the Philippines, Benin, Guinea, Morocco, Burkina Faso, Algeria, Ethiopia, Gabon, Tunisia, Mali, Cote D'Ivoire, and Senegal.

The 2018 International Training Workshop on Focused Ultrasound Therapy for Tumors in Egypt

Twenty-three doctors from Egypt, Sudan, Yemen, Jordan, Kuwait and Nepal joined the Workshop.

# Appendix 6: Excerpts from some selected articles

## 1.Safety and Efficacy of Ultrasound-Guided High-Intensity Focused Ultrasound Treatment for Uterine Fibroids and Adenomyosis

Ultrasound
in medicine and biology

ORIGINAL CONTRIBUTION | VOLUME 45, ISSUE 12, P3214-3221, DECEMBER 01, 2019

Safety and Efficacy of Ultrasound-Guided High-Intensity Focused Ultrasound Treatment for Uterine Fibroids and Adenomyosis

Jae-Seong Lee • Gi-Youn Hong • Kye-Hwa Lee • Jung-Hwa Song • Tae-Eung Kim

Published: September 25, 2019 • DOI: https://doi.org/10.1016/j.ultrasmedbio.2019.08.022 •

Check for updates

Abstract
Key Words
References
Article Info

### Abstract

The objective of this study was to assess the tolerability and efficacy of ultrasound-guided high-intensity focused ultrasound (USgHIFU) ablation using a Haifu JC Focused Ultrasound Tumor Therapeutic System (operating transducer frequency: 0.8 MHz, 300–400 W/cm$^2$) under real-time ultrasound guidance (2.5- to 5.0-MHz imaging probe) for uterine fibroids and adenomyosis in 1807 patients (928 with fibroids and 889 with adenomyosis). Volume change and clinical symptom improvement after treatment were evaluated based on symptom severity scores and health-related quality of life scores using the Uterine Fibroid Symptom and Quality of Life questionnaires. At 3, 6 and 12 mo after treatment, symptom severity scores and health-related quality of life scores and reductions in volumes of uterine adenomyosis and fibroids all revealed good effects. The complication rate was 4.6% (84/1807). With supportive care, all complications resolved without any permanent adverse effects. Thus, USgHIFU is an effective, non-invasive modality for treating uterine fibroids and adenomyosis with manageable complications.

Jae-Seong Lee et al. treated 1807 symptomatic patients with uterine fibroids and adenomyosis by using High-intensity Focused Ultrasound (HIFU) therapy, among which 918 cases were uterine fibroids (size: 2cm-12cm) and 889 cases were focal and diffuse adenomyosis. Exclusion criteria were pedunculated uterine fifibroids, asymptomatic uterine fifibroids <5 cm in diameter, asymptomatic focal adenomyosis, any evidence of known or suspected extensive pelvic adhesions, a history of acute pelvic inflammatory disease, severe pelvic endometriosis, lower abdominal surgery, abdominal wall thickness >5 cm, pregnancy and lactation, dialysis, anticoagulation therapy, hemolytic anemia, history of cerebrovascular disease, unstable cardiac status and suspected malignancy.

4.6% of patients (84/1807) suffered from complications after HIFU therapy. However, with supportive care, all complications recovered without permanent sequelae. Please see Table 5 for the complications after HIFU treatment.

Table 5. Complication profiles after HIFU treatment

| Complication | No. of patients |
|---|---|
| Foot drop | 1 |
| Aggravation of known spondylolisthesis | 1 |
| Transient leg weakness | 7 |
| Transient sciatic nerve pain | 13 |
| Tumor lysis syndrome | 1 |
| Small bowel perforation | 2 |
| Sleep apnea | 1 |
| First-degree burn | 17 |
| Second-degree burn | 12 |
| Transient hematuria | 29 |
| Total | 84 |

HIFU = high-intensity focused ultrasound.

1.7% patients (31/1807) were pregnant unintendedly after HIFU.

Table 6. Outcomes of unintended pregnancies after HIFU treatment

| Pregnancy outcome | Uterine fibroids (N = 13) | Adenomyosis (N = 18) |
|---|---|---|
| Normal spontaneous delivery | 9 | 5 |
| Cesarean section | 3 | 8 |
| Spontaneous abortion | 1 | 2 |
| Premature delivery | 0 | 1 |
| Follow-up loss | 0 | 2 |

It concludes that USgHIFU is an effective, non-invasive modality for treating uterine fibroids and adenomyosis with manageable complications.

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## 2.Outcomes of subsequent pregnancies in patients following treatment of cesarean scar pregnancy with high intensity focused ultrasound followed by ultrasound-guided dilation and curettage


The State Key Laboratory of Ultrasound Engineering in Medicine conducted retrospective analysis of the data collected from 154 patients with CSP who were treated by HIFU followed by USg-D&C in Suining Central Hospital between January 2015 and January 2018. Among them, 28 patients wanted to conceive following treatment. Baseline characteristics, treatment results, intraoperative hemorrhages during USg-D&C, post-curettage serum beta human chorionic gonadotropin (b-hCG) levels and vaginal bleeding were recorded or measured. Subsequent pregnancy outcomes, including intervals between pregnancy and treatment of CSP, complications during pregnancy, and outcomes of newborns were evaluated.

Results: All patients with CSP were successfully treated by HIFU combined with USg-D&C. Of the 28 CSP patients who intended to conceive after the treatment, 23 patients (82.14%) successfully conceived. The average interval between conception and HIFU treatment was 18.38 ± 10.04 months. Eighteen patients (78.26%) had an intrauterine pregnancy, in which 12 had delivery by cesarean section, 1 had an ongoing pregnancy, and 5 had an abortion in the first trimester. Among the other 5 women, 3 had tubal ectopic pregnancy and 2 had recurrent CSP. These five patients

underwent laparoscopy within the first trimester.

Conclusion: HIFU followed by USg-D&C is an effective and safe treatment for patients with CSP who wish to conceive. Prospective multi-center studies with larger sample sizes and longer follow-up periods are needed to compare this treatment with others.

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## 3.Treatment of twin-reversed arterial perfusion sequence using high-intensity focused ultrasound.


Showa University, St. Marianna University, and Tohoku University in Japan co-conducted a clinical research on 6 patients, using HIFU therapy to treat twin-reversed arterial perfusion sequence. They published the research results for the first time online in Wiley Online Library.

Six pregnant women underwent HIFU therapy, five before 16 weeks and one at 26 weeks. Two types of HIFU system were used: the first-generation system, which comprised a biaxial transducer and continuous exposure pattern, and the second-generation system, which comprised a coaxial transducer and sequential exposure pattern. The first-generation

apparatus was used in four cases and the second-generation apparatus was used in two. In three cases, occlusion of the blood vessels mediating flow to the acardiac twin was achieved by HIFU. Two cases experienced intrauterine fetal death despite vessel occlusion. The total survival rate of pump fetuses 2 years after HIFU was 67% and the efficiency rate (the proportion of cases with occlusion or reduced blood flow on ultrasound after HIFU) was 83%. After more than 2 years of follow-up, the surviving infants had no severe clinical complications and no postnatal developmental problems. There was no significant difference in survival rate compared with TRAP cases managed expectantly. Given that complete occlusion of the blood vessels was not achieved in half of the cases, we could not show that HIFU therapy is superior to other treatments. However, HIFU can reduce the cardiac load of the pump fetus and, as it does not require uterine puncture for fetal therapy, there were no fatal complications, such as bleeding, rupture of membranes or infection. Thus, HIFU therapy may represent a less-invasive treatment for TRAP sequence in early pregnancy.

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## 4.Comparison of high-intensity focused ultrasound ablation and secondary myomectomy for recurrent symptomatic uterine fibroids following myomectomy: a retrospective study


Original Article

**Comparison of high-intensity focused ultrasound ablation and secondary myomectomy for recurrent symptomatic uterine fibroids following myomectomy: a retrospective study**

X Liu, J Tang, Y Luo, Y Wang, L Song, W Wang

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A retrospective study by Chinese PLA General Hospital, comparing high-intensity focused ultrasound ablation (HIFUA) and secondary myomectomy for women with recurrent symptomatic uterine fibroids following myomectomy, showed that HIFUA of recurrent symptomatic uterine fibroids offers comparable long-term alleviation of symptoms with longer time interval to reintervention and fewer adverse events compared with secondary myomectomy.

# Appendix 7: References


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