Unilateral Biportal Endoscopic Spine Surgery

Basic and Advanced Technique

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Preface

The endoscopic spine surgery (ESS) has brought a new paradigm in the surgical treatment of spinal disorders about 20 years ago. Since then, there has been a remarkable development in technologies and the biomedical researches that many different approaches and instruments have been developed and applied. This is due to our colleagues, who, as experts in their fields, have dedicated their time and resources in research and shared their knowledge and experiences with others.

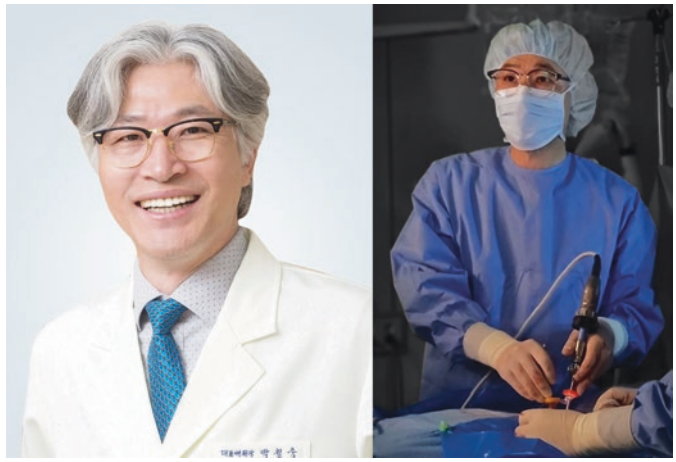
The unilateral biportal endoscopic (UBE) spine surgery has recently applied in ESS as well. Despite some skepticism, it has shown remarkable results and improvement of patients' quality of life after the surgery with significant other pros. UBE has proven to be very effective in certain situations with less hospital stay and postoperative complications leading to increase in the number of UBE performed, becoming one of the significant treatment of choice in recent years. This calls for the need of UBE textbook for those who want to learn the UBE to incorporate in their practice.

This book may give basic scientific knowledge and surgical skills as it has incorporated the advanced biomedical research and clinical practice in the interim. I do believe that this book is a milestone in ESS and definitely becomes a guiding light to many. ESS itself is an innovation and UBE as well, and this won't be the last. This book will provide continuous education to not only those who are new but also with well-established practice and skills.

I am honored to be part of this monumental project and being given the opportunity to endorse the first edition of UBE textbook in the world while I could serve as the third president of UBE research institute of Korea. I wish

to express my appreciation to the authors who have dedicated their time and efforts for this book. This book could not have been edited without the dedicated help of our editor-in-chief, Dr. Dong Hwa Heo. My great respect to the editor-in-chief. Thank you.

Daejeon, Republic of Korea Cheol Woong Park



Preface

Unilateral Biportal Endoscopic Spine Surgery: A New Paradigm in Endoscopic Spine Surgery

Endoscopic spinal surgery is the most minimally invasive spine surgery.

Although the benefits of endoscopic surgery are well known, spine surgeons are difficult to learn because of the steep learning curve. In addition, due to unfamiliar surgical anatomy in endoscopic spine surgery and the possibility of incomplete decompression, it was even more difficult to attempt endoscopic spine surgery.

The basic surgical technique in unilateral biportal endoscopic (UBE) spine surgery is highly similar to microsurgery. Also, because UBE surgeries primarily entail a posterior spinal approach, the anatomical orientation is familiar to spinal surgeons. I believe that UBE is the easiest way to learn spinal endoscopic surgery.

Recently, many spinal surgeons performed UBE surgeries, and many UBE-related articles have been published worldwide. However, no textbook on UBE has been published. Accordingly, the Korean UBE Research Society has invited an expert on UBE to author and compile this textbook. I want to create the UBE textbook with a focus on practical content involving actual UBE surgery. We hope that this textbook published by the UBE Research Society in Korea will be of great help to spine surgeons interested in learning UBE surgery. Also, I would like to express my sincere thanks to the wonderful authors who authored the textbooks.

Seoul, Republic of Korea — Dong Hwa Heo

Preface

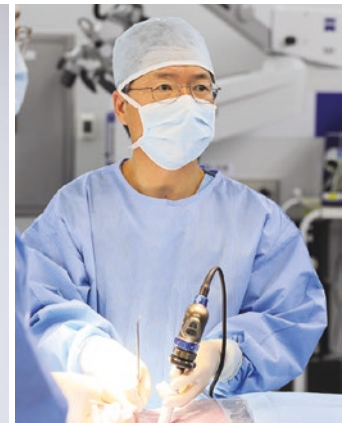
Once in a while, I recall one of my professors in medical school saying "Medical doctors exist because there are patients," which means that the health and happiness of the patients are the most important priority of doctors. While paying my respect to all my senior professors who are fully dedicated to patients in need, I always keep in mind that my utmost mission presently is to research and develop more advanced medical technology based on those valuable find-outs by my seniors of all ages.

The advancement of endoscopic spinal surgery, which embodies the minimal invasiveness including less muscle damage, is critical to preserving the integrity of the spine. The UBE technique combines the accessibility of open surgery, no visual or motion limitations, and the minimal invasiveness of endoscopic surgery. I believe that this harmonized UBE technique can make it happen, so called, the practical better-patient-care. UBE is the abbreviation of unilateral bi-portal endoscopy and it has a different surgical concept comparing the preceding transforaminal spine endoscopy. UBE makes two surgical ports in the same side of the spine, one for the endoscope and the other for the instruments. In the UBE technique, the endoscope and instruments move independently, so it achieves the same free movement that you might have in open surgery. UBE is a surgical technique that allows spine surgeons the freedom to use the same surgical indications as in open surgery while having no concerns that too much tissue damage might be done.

Spinal surgery techniques will be developed that replace the proven technical benefits and improve the shortcomings of our daily surgical routine. I personally hope that the present UBE can help many doctors and patients in

need and be the initial manure to prepare for the quantum jump in the history of spinal surgery advancements. I hope this book helps you proceed on your long-term missionary journey for the better care of spine patients in need.

Busan, Republic of Korea Sang Kyu Son



Preface

My name is Jin Hwa Eum, and it is my pleasure to introduce the UBE technique. Dr. Yeung Chul Choi and I first observed the biportal endoscopic spine surgery technique by Dr. Abdul Gaffar at AAOS, February 28, 2001. It was amazing and innovative, something we did not expect. Inspired, we discussed and studied it, trying to make the surgery easier. Now, the UBE technique has emerged as one of the most promising minimally invasive spine surgeries. During the past two decades, this technique was developed further by collaboration of many Korean spine surgeons. To encourage this teaching and outline the journey, this textbook will be a guide through the complex maze of endoscopic spine surgery.But most importantly, I would like to honor Dr. Choi, all the other authors, and young, ambitious spine surgeons. Finally, I sincerely appreciate all the patients who worked with surgeons to willingly undergo this surgery. Without everyone's endless effort and energy, the UBE technique as we know it wouldn't have been possible.

Al Ain, UAE — Jin Hwa Eum

Congratulatory Address

In recent years, the field of endoscopic spinal surgery has witnessed remarkable advances and development, and endoscopic techniques are now taking their place as important methods for spinal surgery. Once again, I would like to thank the Korean spine surgeons who are leading the global development of endoscopic spinal surgery. I admire their efforts to organize and develop their passion and academic achievements through this textbook. Unilateral biportal endoscopy (UBE), which is considered to be the most innovative method of endoscopic spinal surgery and has recently been developed at a rapid pace, is a broadly-applicable surgical method that can be applied easily even by general spine surgeons. As the editor-in-chief of *Neurospine*, I am proud that many papers related to UBE have been published in *Neurospine* to help establish UBE as a surgical method used across the globe. In the future, we will continue our efforts to support endoscopic spine surgeons to publish many outstanding and innovative studies in *Neurospine*.

Again, as the editor-in-chief of *Neurospine*, I congratulate the authors on publishing this UBE textbook.

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Ha Yoon

Publishing UBE Textbook

"Unilateral biportal endoscopy" has been the key phrase dominating clinical and scientific efforts in all surgical specialties over the last few years. Considering this aspect, a surgical textbook of UBE seemed useful. It has been a very great pleasure for us to review this magnificent textbook, which makes such an impression and contributes so much to its filed.

The editors have gathered experts in UBE and have presented them in a uniform way including the indications/contraindications, instruments, technical aspects of UBE, and complications. The contributors were chosen based on their expertise on a given topic. Each contributor was given the opportunity to describe their surgical techniques beyond that of a journal article or presentation; specifically, they were specifically asked to describe surgical techniques that they employed in performing the operative procedure that would achieve the maximum clinical outcome, while avoiding complications. An attempt was made to keep the text simple and to support it by operative images and video which are as easy to comprehend as possible.

We would like to express our deepest thanks to all authors who have contributed to this textbook and who have provided us with a tremendous amount of new information. We sincerely thank the staff of Springer publishers for their excellent constructive input and assistance with the book and the pleasant collaboration.

This book is a must for every spine surgeon who is contemplating the use of UBE, or has already some experience with them. It is our sincere hope that this book will contribute to the further understanding and acceptance of UBE philosophies in the emerging field of spinal surgery.

Man Kyu Park

Dong Hwa Heo

Ji Yeon Kim

Acknowledgement

This textbook was produced with the support of **the World UBE society, Korean minimally invasive spine surgery society (KOMISS)**, and **Neurospine**, the official journal of ASIA SPINE, the Neurospinal Society of Japan, Taiwan Neurosurgical Spine Society, and the Korean Spinal Neurosurgery Society.

Contents

Part I

Introduction

A Brief History of Unilateral Biportal Endoscopic Spine Surgery

1

Hee Seok Yang, Choon Keun Park, and Jeong Yoon Park

1.1 Introduction

Developments of endoscopy created a subfield of minimally invasive spine surgery that moves the point of visualization away from the surgeon's eye or microscope and puts it directly at the location of spine pathology [1]. Early endoscopic spine surgeons treated disc herniation instead of spinal stenosis and targeted repair of disc herniation that would be less invasive than traditional open techniques. Early endoscopic spine surgery was used primarily to treat disc herniation and proved to be less invasive than traditional open techniques. Surgeons now have the tools and knowledge to treat a myriad of spine pathologies beyond lumbar disc herniation.

The current position of the field of endoscopic spine surgery is the result of two directions of evolution: big-to-small and small-to-big [2]. Using as small as possible conventional incision, minimizing soft tissue damage, endoscopic spine surgery evolved to solve various spine pathologies.

Percutaneous one-portal endoscopic spine surgery has evolved from conventional spine surgery, and unilateral biportal endoscopic (UBE) spine surgery has been developed to overcome limitations of percutaneous one-portal endoscopic spine surgery. This article describes the history of UBE spine surgery and its major milestones and challenges that have resulted in a "powerful" minimally invasive spine surgical technology.

1.2 History

1.2.1 Innovations and the Initiation of UBE Spine Surgeries

In 1996, *De Antoni* et al. published the first technical note in which endoscope and instrument were inserted independently through two portals [3]. Two years later, they described the use of standard arthroscopic instruments for magnification, illumination, and irrigation and reported clinical results [4]. *Soliman* published surgical results for lumbar disc herniation and spinal stenosis in 2013 and 2015, using UBE techniques with independent portals, which is very similar to the current method [5, 6]. The surgical technique shown in Fig. 1.1 appears very similar to today's UBE technique.

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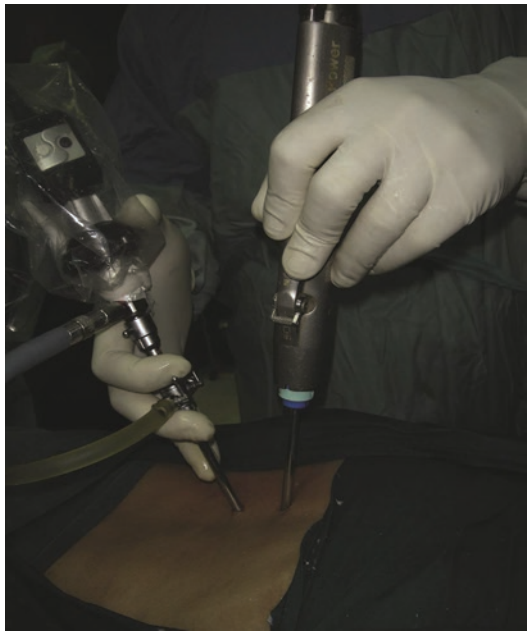

Fig. 1.1 Intraoperative image showing endoscope and arthroscopic shaver introduced through two separate portals. Figure from *Soliman*'s papers in 2013 and 2015

The term "biportal" was used first in 2016, and "UBE" was introduced in an article published in Korea [7–10]. Increased experience of endoscopic spine surgeons with UBE has led to an explosion of innovation, mainly in Korea. As a result, Korean surgeons were able to apply the UBE technique to various pathologies such as thoracic ossified yellow ligament and cervical approaches [11], which are considered challenging, as well as relatively common applications such as lumbar spinal stenosis [9], far-lateral disc herniation [12, 13], recurrent disc herniation [8], discitis, and abscess [14]. The biportal approach has enabled endplate preparation and foraminal decompression under direct visualization, which is vital for lumbar interbody fusion [15, 16]. All major UBE-related papers since 2016 have been published in Korea, which is attributed to Korea's independent history of UBE.

Based on various trials and clinical results of UBE, systematic reviews of literature and prospective randomized comparative studies have assessed the feasibility of spinal decompression [17, 18], and studies for maintaining stable water dynamics have been reported because it is an important step to a safer technique [19, 20]. Currently, UBE is recognized as the most important endoscopic surgery of the spine and can be applied in all areas of lumbar degenerative disease, including fusion, and can be applied to the cervical spine.

1.3 Brief UBE History in Korea

Abdul Gaffar presented the article, "Lumbar Disc Excision by Midline Extradural Endoscopy," at the 68th American Academy of Orthopedic Surgeons (AAOS) in 2001. Korean Dr. Young Chul Choi visited *Abdul Gaffar* in 2002, and began implementing UBE with *Uhm Jin-Hwa* for the first time in Korea (Fig. 1.2). In 2003, Jin Hwa Eum presented the article, "Endoscopic lumbar discectomy for far-lateral disc herniation," with biportal endoscope, at the 4th Biennial Korea-Japan Conference on Spine Surgery, in Japan. In 2013, Dr. Eum and another Korean UBE pioneer Sang Kyu Son presented, "Unilateral biportal endoscopic segmental sub-laminoplasty for lumbar central stenosis," at the International Society of Minimally Invasive Spine Surgery (ISMISS) in Japan. In 2013, Sang Kyu Son presented, "The endoscopic unilateral laminectomy and bilateral decompression (ULBD), foraminotomy and fusion using UBE," at the International Intradiscal Therapy Society (IITS) in Korea (Fig. 1.3). Workshops on UBE led by Sang Kyu Son were held for the first time in Korea in 2013 (Fig. 1.4).

In Korea, since 2002, independent trials and research of UBE have been conducted, and full-scale presentations of research results and related workshops have been held since 2013. Based on these achievements, The UBE Research Society was organized in 2017 and has contributed to the development and popularization of UBE procedures through its academic activities. The unique history of UBE in Korea includes a background that led to various research achievements and attempts related to UBE.

Fig. 1.2 (**a**) *Abdul Gaffar* presenting in 2001, and (**b**) Photograph of *Abdul Gaffar* (Rt) and Jin Hwa Eum (Lt) in 2018

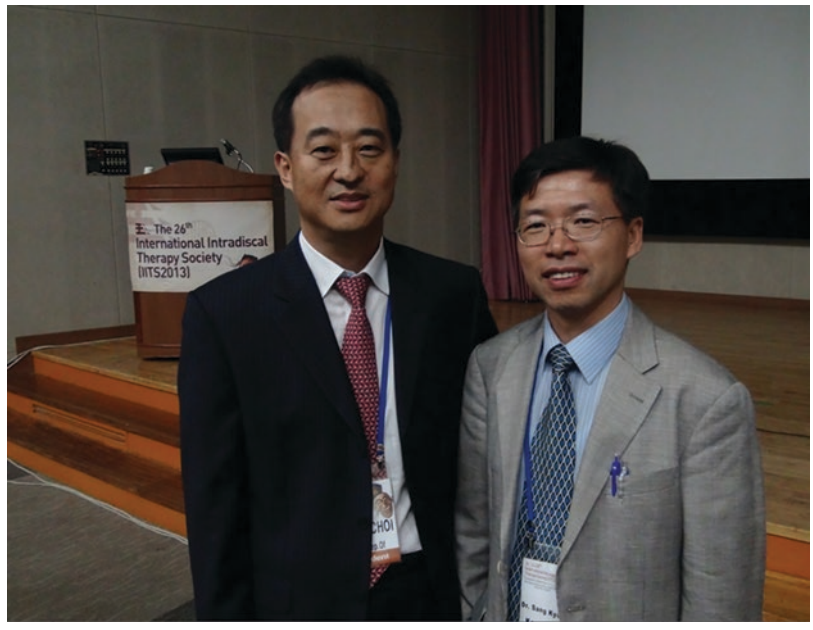

Fig. 1.3 Photograph of *Gun Choi* (Lt, President of International Intradiscal Therapy Society 2013) and Sang Kyu Son (Rt), in 2013

Fig. 1.4 UBE Korean live surgery (**a**) and seminar (**b**) in 2014

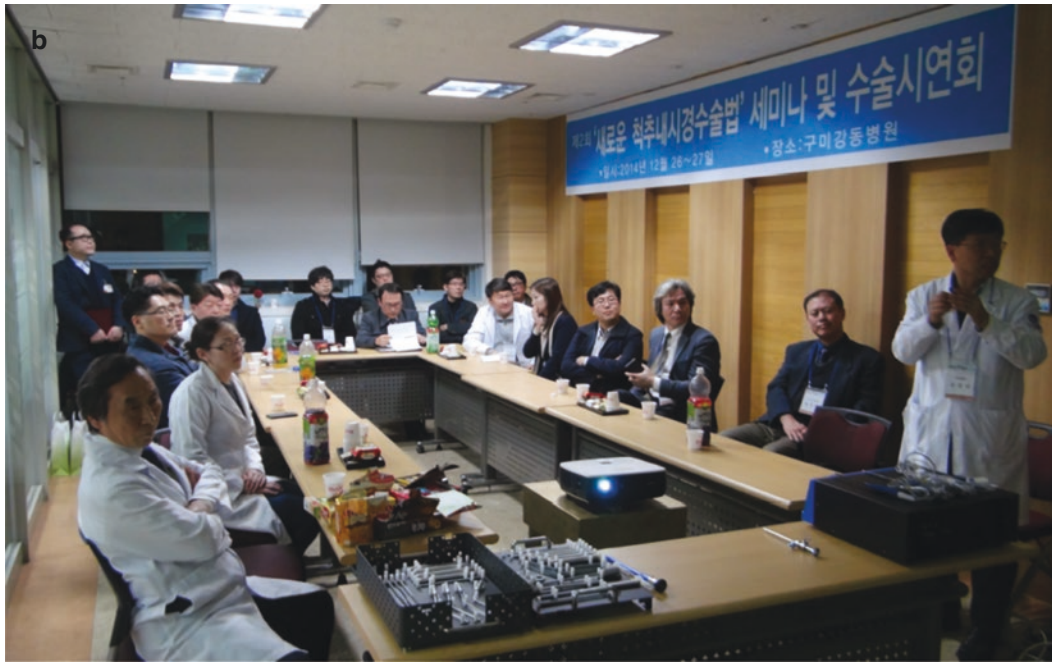

Fig. 1.4 (continued)

1.4 Future of UBE

The advantages of continuous irrigation (hemostasis, flushing of small bleeding, identification of the bleeding source, better identification of microanatomy, and separation of tissue layers by simple irrigation) and developments of instruments increased success rates and decreased recurrence rates of spinal surgeries using UBE. The indication spectrum of UBE spine surgery is expected to become wider and possibly cover all types of degenerative spinal pathologies.

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