ELSEVIER

JMIG The Journal of Minimally Invasive Gynecology

Original Article

The Power Law of Learning in Transumbilical Single-Port Laparoscopic Subtotal Hysterectomy

Shu-Han You, MD, Chen-Ying Huang, MD, Hsuan Su, MD, Chien-Min Han, MD, Chyi-Long Lee, MD, PhD, and Chih-Feng Yen, MD, PhD

From the Department of Obstetrics and Gynecology, Linkou Chang Gung Memorial Hospital, Tao-Yuan, Taiwan (Drs. You, Huang, Su, Han, and Yen), Keelung Chang Gung Memorial Hospital, Keelung, Taiwan (Dr. Lee), and Chang Gung University College of Medicine, Tao-Yuan, Taiwan (all authors).

ABSTRACT **Study Objective:** To analyze the surgical outcomes and learning curve of transumbilical single-port laparoscopic subtotal hysterectomy, which requires sutures of the cervical stump.

Design: A prospective observational study (Canadian Task Force classification II-2).

Setting: A university-affiliated center.

Patients: From the first (July 2012) and consecutive patients of benign uterine disease scheduled for subtotal hysterectomy until October 2013.

Interventions: All single-port laparoscopies were performed using straight instruments by 1 gynecologist. An ancillary port was added whenever technical difficulties could endanger surgical quality.

Measurement and Main Results: Seventy-five patients were recruited for intention-to-treat analysis with a mean (±SD) age of 44.7 ± 3.8 years and a body mass index of 24.2 ± 3.7 kg/m^2. No major complication was noted. The mean uterine weight was 432.5 ± 344.0 g with 24 (32%) uteri ≧500 g. The patients' sequential order, or gradually increasing experience, was the determining factor in progressively decreasing operative time. Furthermore, most cases that required an additional ancillary port (67%) were clustered in the first 20 cases, whereas 4 were scattered after the 47th patient because of severe pelvic adhesion. The mean operative time decreased in the power law function of the patients' sequential order with a plateau achieved at the 20th patient.

Conclusion: The patients' sequential order was identified as an independent factor of achieving purely single-port access, and the trend of decreasing operative time delineated the existence of a learning curve. Approximately 20 patients were needed for an experienced multiport laparoscopist to reach technical competency in the current series. Journal of Minimally Invasive Gynecology (2018) ■■, ■■–■■ © 2018 AAGL. All rights reserved.

Keywords: Subtotal hysterectomy; Laparoendoscopic single-site surgery; Single-port laparoscopy; Power law

With the accumulation of clinical experiences and the innovation of endoscopic instruments, transumbilical single-port laparoscopic surgery has been introduced as an alternative to multiport laparoscopy [1–3]. Total hysterectomy by single-port laparoscopy was shown to be feasibly performed with comparable surgical outcomes to conventional multiport laparoscopy [4–7] in association with a lower risk of epigastric vessel injury, wound infection, and herniation [8]. Although offering better cosmetic benefits, single-port laparoscopy was frequently questioned by drawbacks of the crowding, clashing, and loss of triangulation among each working instrument as well as the in-line vision of these instruments with the laparoscope [9].

Subtotal hysterectomy has had an increasing trend in our country in recent years [10]. After excluding the existence

Conflict of Interest: The authors declare that they have no conflict of interest.

Supported in part by Chang Gung Memorial Hospital research grants (CMRPG390901) to Dr. Lee and research grants of National Science Council, Ministry of Science and Technology grant number NMRPG3F0551 (105-2314-B-182A-110-) to Dr. Yen.

Presented in part at the 43rd Global Congress of Minimally Invasive Gynecology, November 17–21, 2014, Vancouver, British Columbia, Canada.

Corresponding author: Chih-Feng Yen, MD, PhD, Department of Obstetrics and Gynecology, Chang Gung Memorial Hospital (Linkou), 5, Fu-Hsin St, Kwei-Shan, Tao-Yuan, Taiwan 33305.

E-mail: yen2158@cgmh.org.tw

Submitted June 13, 2017. Accepted for publication January 14, 2018.

Available at www.sciencedirect.com and www.jmig.org

1553-4650/$ — see front matter © 2018 AAGL. All rights reserved.

https://doi.org/10.1016/j.jmig.2018.01.015

of cervical pathology, the principle of choosing between total or subtotal hysterectomy was based on the patients' preference [11,12], which could have been influenced by the surgeon's experience and the advice offered to patients. Laparoscopic subtotal hysterectomy, which requires suture repair of the cervical stump in our practice, is more technically demanding than laparoscopic-assisted vaginal hysterectomy (LAVH), especially in the single-port setting [13].

The existence of a learning curve is inherent to any learning situation of complex skills, showing a characteristic feature of unstable and variable performance at the initial stage followed by a slowing down of improvement after a repetition of practice over time and finally reaching a false asymptote (plateau) [14,15]. Competency was defined at a point where the slope changed from steep to more moderate [16], which reflects the achievement of satisfactory depth perception and bimanual dexterity as well as the adequacy of delicacy and efficiency of tissue handling in laparoscopy [17].

We struggled during the initial stage while trying to achieve competency in performing subtotal hysterectomy by single-port access. Fortunately, the difficulty and restriction in the single-port setting could be ameliorated by adding ancillary trocar(s) in either lower quadrant area, which then converts the setting into a conventional multiport access to avoid complications or adverse outcomes. The aim of this study was to analyze the learning curve effects and possible predisposing factors, if any, that existed in our initial period of performing transumbilical single-port laparoscopic subtotal hysterectomy (sp-LSH).

Materials and Methods

The study was reviewed and approved by the institutional review board of the Human Investigation and Ethical Committee of Chang Gung Medical Foundation (Project #103-2243B). Written informed consent was obtained from each patient for surgery. The feasibility of the operation and its learning curve were analyzed in an intention-to-treat principle. All surgeries were performed by a gynecologic endoscopist well experienced in conventional multiport techniques (C.F.Y.).

Patients

Consecutively every patient with a normal Papanicolaou smear, without a history of cervical intraepithelial neoplasm, and scheduled for subtotal hysterectomy for a uterine leiomyoma or adenomyosis in Chang Gung Memorial Hospital, Tao-Yuan, Taiwan, were prospectively recorded from July 2012 when we began to perform transumbilical sp-LSH until October 2013. Patients with obesity, large uteri, or repeated previous cesarean sections or abdominal surgeries were not excluded; however, those with any suspicion of malignancy and inappropriate physical status for general anesthesia or contraindicated to laparoscopy were excluded.

Surgical Instruments

The transumbilical single port was established either by using the commercially available Lagi-port System (LAGIS, Taichung, Taiwan), which is composed of a LapShield (LAGIS) wound retractor and a removable laparoscopic multichannel cap (Fig 1A), or the self-assembled retractor and glove system, which was composed of a small Alexis wound retractor (Applied Medical Resources Corp, Rancho Santa Margarita, CA) with a disposable surgical glove fixed with laparoscopic cannulas (Fig 1B) wrapped on its outer rim [7,18]. The uterus was handled intraoperatively with the Pelosi (CooperSurgical, Tumbull, CT) or Cohen (KARL STORZ

Fig. 1

The surgical umbilical ports include (A) the LAGIS port and (B) the self-assembled retractor and glove system.