

# Anesthetic Management for Esophageal Stent Placement in an Endoscopy Unit Outside Operating Room

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**Background:** Esophageal stent placement is a minimally invasive procedure for treatment of esophageal strictures that cannot be treated with surgical procedure. It requires some forms of anesthesia. This procedure could be performed in the operating room and in the endoscopy unit.

**Objective:** The study is aimed to report and evaluate the choices and techniques, drugs used and complications of anesthesia in the patients undergoing esophageal stent placement procedure in an endoscopy unit outside the operating room in a developing country.

**Material and Method:** Retrospectively analyzed the patients on whom esophageal stent placement had been performed during the period of January, 2010 to December, 2012 in Siriraj Hospital in Thailand. The patients' characteristics, pre-anesthetic problems, anesthetic techniques, drugs, duration of anesthesia, and anesthesia-related complications were assessed and summarized by using descriptive statistics.

**Results:** During the study period, there were 48 procedures. Mean age  $63.7 \pm 13.4$  years. The majority of them was male (72.9%) and classified in ASA physical status II (52.1%). Mean duration of anesthesia was  $60.6 \pm 36.1$  minutes. Most common pre-anesthetic problems were hematologic disease (64.6%), electrolyte imbalance (50.0%), respiratory disease (31.3%) and hypertension (29.2%). General anesthesia with endotracheal tube (64.6%) was the main anesthetic technique. The mainly used sedoanalgesic agents were propofol, fentanyl and midazolam. The most common neuromuscular blocking drugs were succinylcholine and atracurium. Additionally, sevoflurane was the most inhalation agent. The overall anesthesia-related complication rate was 35.4%. Hypotension (31.3%) was the most frequent anesthetic complication.

**Conclusion:** All of the esophageal stent placement procedures, general anesthesia and intravenous sedation techniques could be performed effectively in the appropriate patients. However, clinical signs should be carefully observed and the anesthetic personnel had to optimize the patient's condition for safety and beware of complications.

**Keywords:** Anesthetic management, Esophageal stent, Esophageal stricture, Efficacy, Safety, Endoscopic unit, Outside operating room, Developing country

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Esophageal stents are important tools for the palliative treatment of inoperable esophageal malignancies. With the development of multiple self-expandable stents, there are now several therapeutic options for managing benign and malignant esophageal diseases<sup>(1)</sup>. To date, the indications for esophageal stent placement have also expanded. Starting with the palliative treatment of malignant esophageal strictures, indications now include strictures from the extrinsic compression, malignant perforations and fistulas, and recently, the benign conditions such as unmanageable

esophageal strictures, perforations, fistulas, and bleeding esophageal varices<sup>(2)</sup>. The esophageal stent placement procedure can be performed under fluoroscopic guidance or with a combination of fluoroscopic and endoscopic techniques.

Over the years, the patients also have changed. There are increasingly patients at the extremes of health status and patients with a multitude of comorbid problems. In our center, most of these procedures are performed by endoscopists under some form of anesthesia. The choices and techniques of anesthesia and drug selection vary according to the condition of the patients, familiarity of the anesthesiologists and satisfaction of the endoscopists<sup>(3)</sup>. Little is known about how practices in anesthesia and monitoring during esophageal stent placement procedure in the endoscopy unit outside

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the operating room in the developing countries. Consequently, the anesthesia-related complication rates have changed over time. The aim of this study was to report and evaluate the choices and techniques of anesthesia, drug usage and complications during and immediately after the esophageal stent placement procedure. Moreover, this present study was also conducted in order to adapt and keep data for further research in the near future.

### Material and Method

Data were reviewed from anesthetic, procedure records and history charts of the patients who underwent esophageal stent during a period from January, 2010 to December, 2012 at Siriraj Hospital, Thailand. The general data included gender, age, weight, height and American Society of Anesthesiologists (ASA) physical status. The anesthetic data included pre-anesthetic problems, choice of anesthesia, duration of anesthesia, anesthetic drug usage, hemodynamic parameters including systolic and diastolic blood pressure, heart rate and oxygen saturation as well as anesthesia-related complications.

### Statistical analysis

Results were reported as mean and standard deviation (SD) or percentage (%) when appropriate. The statistical software package SPSS for Window Version 18 (SPSS Inc., Chicago, IL) was used to analyze the data.

### Results

There were 48 esophageal stent placement procedures performed during the study period. The majority of the patients were male (72.9%) with ASA physical status II (52.1%). Mean age was  $63.7 \pm 13.4$  years. The mean duration of anesthesia was  $60.6 \pm 36.1$  minutes. Most of pre-anesthetic problems were hematologic disease (64.6%), electrolyte imbalance (50.0%), respiratory disease (31.3%) and hypertension (29.2%) (Table 1). Clinical monitoring observed by the anesthetic personnel consisted of noninvasive blood pressure, heart rate, pulse oxymetry, and electrocardiogram.

Table 2 shows anesthesia-related data. The majority of the procedures were carried out under general anesthesia with endotracheal tube (64.6%). The mainly used sedoanalgesic agents were propofol, fentanyl and midazolam. The most common neuromuscular blocking drugs were succinylcholine

**Table 1.** Characteristics of patients, duration of anesthesia and pre-anesthetic problems

Patient number (n)	48
Age (year) (mean, SD)	63.7 (13.4)
Gender (%): Male	35 (72.9)
Weight (kg) (mean, SD)	49.3 (8.5)
Height (cm) (mean, SD)	162.1 (6.0)
ASA physical status (n, %)	
I	0
II	25 (52.1)
III	23 (47.9)
Duration of anesthesia (min) (mean, SD)	60.6 (36.1)
Pre-anesthetic problems (n, %)	
Hematologic disease	31 (64.6)
Electrolyte imbalance	24 (50.0)
Respiratory disease	15 (31.3)
Hypertension	14 (29.2)
Cardiovascular disease	10 (20.8)
Diabetes mellitus	8 (16.7)
Others	19 (39.6)

**Table 2.** Anesthesia-related data (n, %)

Anesthetic technique	
Intravenous sedation	15 (31.3)
General anesthesia with endotracheal tube	31 (64.6)
General anesthesia via tracheostomy tube	2 (4.2)
Intravenous drugs	
Propofol	45 (93.8)
Thiopental	3 (6.3)
Midazolam	20 (41.7)
Fentanyl	46 (95.8)
Ketamine	2 (4.2)
Succinylcholine	27 (56.3)
Atracurium	14 (29.2)
Cis-atracurium	10 (20.8)
Vecuronium	1 (2.1)
Rocuronium	2 (4.2)
Inhalation agents	
Nitrous oxide	8 (16.7)
Isoflurane	3 (6.3)
Sevoflurane	25 (52.1)
Desflurane	3 (6.3)

and atracurium. In addition, sevoflurane was the most inhalation agent. These anesthetic drugs are usually utilized in a combination regimen.

Table 3 demonstrates the hemodynamic parameters including systolic and diastolic blood pressure, heart rate and oxygen saturation. In addition, anesthesia-related complications during and

**Table 3.** Hemodynamic parameters: systolic and diastolic blood pressure (mmHg), heart rate (beat/minute) and oxygen saturation (SpO<sub>2</sub>, %) (mean, SD)

	SBP	DBP	HR	SpO <sub>2</sub>
Baseline	132.1 (22.0)	75.6 (11.4)	78.0 (11.8)	99.4 (1.3)
At endoscope insertion	125.0 (23.3)	73.3 (12.5)	79.3 (14.8)	100.0 (0.0)
5 min after insertion	116.9 (22.9)	70.3 (13.4)	77.3 (14.7)	99.9 (0.1)
10 min after insertion	119.3 (22.6)	71.6 (12.1)	77.9 (14.5)	100.0 (0.0)
15 min after insertion	119.5 (20.7)	71.7 (11.4)	78.0 (15.2)	100.0 (0.0)
20 min after insertion	119.8 (21.7)	72.3 (11.6)	78.6 (15.0)	100.0 (0.0)
25 min after insertion	120.1 (21.7)	72.1 (11.7)	78.6 (14.4)	100.0 (0.0)
30 min after insertion	122.2 (19.8)	73.1 (11.1)	81.7 (14.9)	100.0 (0.0)
35 min after insertion	115.7 (18.3)	70.7 (13.2)	81.1 (16.8)	100.0 (0.0)
40 min after insertion	116.9 (18.7)	70.5 (13.3)	81.1 (16.1)	100.0 (0.0)
45 min after insertion	118.7 (20.3)	70.6 (12.8)	83.5 (14.9)	100.0 (0.0)
50 min after insertion	118.2 (21.9)	69.9 (12.7)	81.0 (14.6)	100.0 (0.0)
55 min after insertion	113.9 (14.7)	70.9 (13.5)	84.1 (15.0)	100.0 (0.0)
60 min after insertion	115.7 (16.6)	71.6 (11.4)	85.2 (15.2)	100.0 (0.0)

SBP = Systolic blood pressure; DBP = Diastolic blood pressure; HR = Heart rate; SpO<sub>2</sub> = Oxygen saturation

immediately after the procedure are demonstrated in Table 4. No serious anesthetic complications occurred during the study. The overall anesthesia-related complication rate was 35.4%. The majority of these complications was cardiorespiratory system in nature and was associated with sedation and analgesia. Hypotension (31.3%), which was promptly corrected by administration of vasopressor and fluid loading, was the most frequent anesthesia-related complication. The other anesthesia-related complication was bradycardia (4.2%).

### Discussion

Esophageal stents remain important tools for the palliative treatment of inoperable esophageal cancers. To date, the multiple stents have been developed. There are several therapeutic options for management of benign and malignant esophageal diseases. Furthermore, the minimally invasive approach of esophageal stenting has improved the quality of life of these patients, who would otherwise face a possibly morbid surgical procedure or who might have limited treatment options because of several comorbidities<sup>(1,2,4)</sup>. Esophageal stent placement is associated with less invasiveness and complications, shorter hospital stay, and lower cost. However, there have been some problems of stent-related complications including stent migration and reobstruction. Currently, the newly-developed stents such as biodegradable stents are expected to overcome these limitations and to be

**Table 4.** Anesthesia-related complications during and immediately after the procedure (n, %)

Overall	17 (35.4)
Hypotension	15 (31.3)
Bradycardia	2 (4.2)

extended to the benign esophageal diseases as well as malignant obstruction<sup>(5)</sup>.

Esophageal stent placement is commonly used in the patients with esophageal malignancies. For benign esophageal strictures, the primary treatment is balloon dilation. However, approximately 10% of the strictures are not improved after balloon dilation. Fully covered, self-expandable metallic stents are used for refractory benign strictures. However, major complications such as stent migration and tissue overgrowth make the long-term results unfavorable. Stent placement has been regarded as an essential complementary procedure to balloon dilation for benign esophageal strictures. Clinical practice and knowing the advantages and disadvantages of different stents encourage esophageal stent evolution<sup>(6)</sup>.

The role of the anesthesiologist in the esophageal stent placement procedure is to facilitate patient safety and procedural efficacy as well as to ensure that the patient will have minimal pain during and after the procedure. To date, there is evidence that esophageal stent placement procedure could be safely

performed with sedation and/or general anesthesia. Although the use of sedation and/or anesthesia during this procedure is supposed to be extensively accepted, the data from different studies indicate that patterns of use of anesthetic agents may principally depend on cultural, or even regional and local differences. In fact, the data used to evaluate the safety of sedation/anesthesia during esophageal stent placement procedure were derived mainly from several studies conducted in the developed countries. There are limited data in the developing countries.

Our study demonstrated that general anesthesia technique was commonly used for the esophageal stent placement procedure in an endoscopy unit outside the operating room. Sedation for esophageal stent placement procedure is intended to provide moderate to deep sedation as defined by the American Society of Anesthesiologists (ASA)<sup>(7)</sup>. The proper administration of sedation and/or anesthesia for this procedure is as essential to the successful procedure as skillful maneuvering of the endoscopist. Recently, there are concerns about our practice or sedation and anesthesia, involving issues of safety, patient satisfaction, and cost. The goal of anesthesia during this procedure is to relieve the patient's preexisting pain and anxiety as well as the pain of the procedure itself, and the amount of postoperative pain expected. The level of sedation/anesthesia is balanced with the stimulus of the procedure.

The differences in usage of sedation and anesthesia between different countries have been accredited to cultural differences. In Siriraj Hospital, intravenous sedation technique is commonly used for various procedures outside the operating room<sup>(8-11)</sup>. In our experience, the authors usually use general anesthesia with endotracheal tube for esophageal stent placement in the patients with esophageal malignancies, patients with full stomach, and patients with high risk of aspiration. Consequently, intravenous sedation is utilized in patients without risk of aspiration, patients with benign esophageal pathology, and in non-complicated procedures. The selection of an anesthetic technique for this procedure is similar to the other centers. General anesthesia with end tracheal tube has several advantages including prevention of an aspiration risk, a high successful completion rate, and hemodynamic stability. In contrast, intravenous sedation requires an experienced anesthesiologist, and risks for cardiorespiratory adverse events.

The commonly used anesthetic drugs are shorter-acting benzodiazepines (midazolam) and

narcotics (fentanyl) because of their relatively rapid onset and rapid offset<sup>(11,12)</sup>. Importantly, these anesthetic drugs can be reversed by the appropriate medication. Additionally, the use of propofol had been widely used by anesthesiologists during the procedure. It has anxiolytic, hypnotic, amnesic, antiemetic and anesthetic properties. Propofol also potentiates the effects of narcotics and sedatives. However, propofol associated with cardiorespiratory depression including hypotension, respiratory depression and airway obstruction<sup>(3,12,13)</sup>. In addition, the use of propofol for sedation requires specific training and experience and should be rigorously offered only under optimal conditions<sup>(14)</sup>. Succinylcholine is commonly used for tracheal intubation because of rapid sequence induction. In addition, short and intermediate acting neuromuscular blocking drugs such as atracurium, cis-atracurium and rocuronium are usually utilized to maintain anesthesia. Similarly, sevoflurane and desflurane are the most common inhalation agents used during anesthesia.

Moreover, a previous report showed that topical pharyngeal anesthesia could be utilized for the esophageal stent placement procedure. Valley et al compared the sedation requirement in the patients receiving standard topical local anesthesia versus the patients receiving peroral pharyngeal plexus block. The authors concluded that pharyngeal plexus block had profound anesthesia and suppression of the gag reflex. In addition, the patients receiving only topical anesthesia and intravenous sedation tolerated the procedure poorly and required a greater amount of intravenous drug than patients in the pharyngeal plexus block group<sup>(15)</sup>.

The stent placement is subject to technical consequences. There are some risks and complications that can occur following esophageal procedures. Intra-procedural complications include those associated with sedation and/or anesthesia, aspiration, malpositioning of the stent, and esophageal perforation. Early post-procedural complications may include chest pain, bleeding, and tracheal compression. Moreover, late complications include stent migration, bleeding, perforation, esophageal fistula, and stent occlusion<sup>(16)</sup>. However, this study does not focus on procedure-related complications. The patients undergo stent placement with deep sedation or with general anesthesia are the potential for risks. The present study clearly recommends that cardiovascular complications may be significantly more frequent in the patients who undergo this procedure. The most common

complication was hypotension. In Siriraj Hospital, there were no serious anesthesia-related complications occurred during the study. Furthermore, the incidence rate of anesthesia-related complications during and after esophageal stent placement procedure is comparable with other outside operating room procedures<sup>(8-10)</sup>.

There are several limitations of this study that should be noted. First, the present report is retrospective in nature. The main limitation of this study is its reliance on self-reported data. These self-reporting data may tend toward an underestimation of unpleasant data. Second, this is a single-center study in Thailand. These results could not be reproducible constantly in other settings. Third, there are several anesthesiologists and endoscopists performed this procedure. A wide variability of the experience might be occurred. The authors therefore assume that the data are realistic and reveal daily clinical practice. Finally, our results may not be applicable to patients in the developed countries.

In conclusion, esophageal stent placement is a minimally invasive procedure for treatment of esophageal strictures that cannot be treated with surgical procedure. It requires some forms of anesthesia. Cardiovascular-related complication is the most frequent anesthetic complication. Anesthesia by anesthetic personnel appears to be safe and effective. There was no need for special techniques or drugs in anesthesia. However, clinical signs should be cautiously observed and the anesthetic personnel had to optimize the patient's condition for safety and beware of complications.

#### **What is already known on this topic?**

Esophageal stent placement is a minimally invasive procedure for treatment of esophageal strictures that cannot be treated with surgical procedure. It requires some forms of anesthesia. Cardiovascular-related complication is the most frequent anesthetic complication. Anesthesia by anesthetic personnel appears to be safe and effective. There was no need for special techniques or drugs in anesthesia. In the setting of an endoscopy unit outside the operating room in a developing country, esophageal stent placement procedure can be performed safely and effectively under anesthesia by anesthetic personnel.

#### **What this study adds?**

Anesthesia for esophageal stent placement procedure is challenging. This report shows the efficacy of sedation and anesthesia for this procedure. Intravenous sedation could be performed in the

appropriate patients with proper assessment and preparation as well as adequate monitoring. However, anesthesiologists commonly use general anesthesia with end tracheal tube because of easier control of cardio respiratory function. Further randomized control studies need to be evaluated.

#### **Potential conflicts of interest**

None.

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## การระงับความรู้สึกสำหรับใส่ท่อหลอดอาหารในศูนย์ส่องกล้องระบบทางเดินอาหารนอกห้องผ่าตัด

สมชาย อมรโยธิน, สุกัญญา จิระชัยพิทักษ์, สุรัสวดี วัฒนวิทย์

**ภูมิหลัง:** หัตถการใส่ท่อหลอดอาหารเป็นหัตถการชนิดหนึ่งสำหรับผู้ป่วยที่มีหลอดอาหารตีบตัน และไม่เหมาะสำหรับการผ่าตัด การทำหัตถการชนิดนี้จำเป็นต้องใช้การระงับความรู้สึกสามารถทำได้ทั้งในห้องผ่าตัดและในห้องส่องกล้องนอกห้องผ่าตัด

**วัตถุประสงค์:** ศึกษาชนิดของการระงับความรู้สึก ยาระงับความรู้สึกที่ใช้ และภาวะแทรกซ้อนของการระงับความรู้สึกสำหรับผู้ป่วยที่รับการใส่ท่อหลอดอาหารในหัตถการส่องกล้องนอกห้องผ่าตัดในประเทศกำลังพัฒนาแห่งหนึ่ง

**วัสดุและวิธีการ:** ศึกษาย้อนหลังผู้ป่วยที่รับการใส่ท่อหลอดอาหารระหว่างเดือนมกราคม พ.ศ. 2553 จนถึงเดือนธันวาคม พ.ศ. 2555 ในโรงพยาบาลศิริราช ประเทศไทย บันทึกข้อมูลทั่วไปของผู้ป่วย โรคหรือปัญหาก่อนการระงับความรู้สึก ชนิดของการระงับความรู้สึก ยา และระยะเวลาของการระงับความรู้สึกที่ใช้ รวมทั้งภาวะแทรกซ้อนของการระงับความรู้สึก

**ผลการศึกษา:** ผู้ป่วยทั้งหมด 48 คนรับการใส่ท่อหลอดอาหารอายุเฉลี่ยของผู้ป่วย  $63.7 \pm 13.4$  ปี ส่วนใหญ่เป็นผู้ชาย (72.9%) และ ASA physical status II (52.1%) ระยะเวลาเฉลี่ยของการระงับความรู้สึกยาระงับความรู้สึกที่ใช้  $60.6 \pm 36.1$  นาที โรคหรือปัญหาก่อนการระงับความรู้สึกที่พบบ่อย คือ โรคเลือด (64.6%), ความผิดปกติของอิเล็กโทรไลต์ (50.0%), โรคระบบทางเดินหายใจ (31.3%) และความดันโลหิตสูง (29.2%) ส่วนใหญ่ใช้การระงับความรู้สึกทั่วตัวและใส่ท่อช่วยหายใจ (64.6%) ยาระงับความรู้สึกที่ใช้ส่วนใหญ่ คือ propofol, fentanyl และ midazolam ยาหย่อนกล้ามเนื้อ คือ succinylcholine และ atracurium ยาดมสลบ คือ sevoflurane พบภาวะแทรกซ้อนของการระงับความรู้สึกทั้งหมด 35.4% ภาวะความดันเลือดต่ำพบได้บ่อยที่สุด (31.3%)

**สรุป:** การทำหัตถการใส่ท่อหลอดอาหารในผู้ป่วยที่เหมาะสมสามารถทำได้สำเร็จโดยวิธีการระงับความรู้สึกทั่วตัวและการทำให้ผู้ป่วยหลับและสงบ อย่างไรก็ตามการเฝ้าระวังการเปลี่ยนแปลงทางคลินิกของผู้ป่วยและภาวะแทรกซ้อนของการระงับความรู้สึกที่อาจเกิดขึ้นมีความจำเป็น