

# Patient Positioning Guidelines for Gastrointestinal Endoscopic Procedures

## ABSTRACT

Patient positioning during gastrointestinal endoscopic procedures has received minimal attention compared with surgical procedures performed in the surgical setting. However, prolonged endoscopic interventions on patients and the increasing requirement for general anesthesia have changed the need for patient positioning guidelines. The objective of this study was to test whether patient positioning guidelines for surgical procedures in surgical suites are suitable for gastrointestinal endoscopic procedures without negatively impacting safety and procedure duration. This was an observational feasibility study with volunteers of different body mass index categories. Volunteers were positioned in supine, lateral, and prone positions on an operating table and thereafter on an endoscopy stretcher and asked for comfort levels. Except for arm and head positioning in lateral and prone positions, it was possible to replicate the patient positioning guidelines. Alternative options were explored for the positioning of arms and head to optimize oral access. Besides minor adjustments, we were able to replicate the positioning guidelines and adhere to pressure and nerve injury prevention guidelines. Concept endoscopic patient positioning guidelines were developed. It is recommended to review the “swimmer’s” position. Endoscopic patient positioning guidelines should become part of the National Practice Standards and education curriculum of endoscopy nurses.

Historically, gastroenterologists in endoscopy units independently performed diagnostic endoscopic procedures without any patient sedation at all or administered sedation themselves consisting of benzodiazepines and analgesics, which are usually isolated from the main surgical suite complex. Diagnostic gastrointestinal endoscopic procedures comprise the majority of the caseload, which rarely exceed a duration of 30–60 minutes per case. This might explain why patient positioning has received minimal attention in endoscopy compared with surgical procedures performed

in the surgery setting. Over the last decades, however, advanced endoscopic interventions (e.g., peroral endoscopic myotomy and endoscopic sleeve gastropasty) have become established in expert centers with procedure durations far beyond 60 minutes, and in extreme cases up to several hours, frequently requiring general anesthesia.

## Background

O’Connell (2016) reported that interventions lasting more than 2 hours have a 50% increased risk for pressure injuries (PIs). As defined by the United States

Received March 4, 2020; accepted April 23, 2020.

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A research grant was obtained from the Australian College of PeriAnaesthesia Nurses to complete this study.

The author declares no conflicts of interest.

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DOI: 10.1097/SGA.0000000000000534

National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific Pressure Injury Alliance, a PI is a localized injury to the skin and/or underlying tissue, usually over a bony prominence, resulting from sustained pressure, including pressure associated with shear (National Pressure Ulcer Advisory Panel, 2014). A pressure on tissue more than 32 mmHg causes disruption of tissue perfusion and consequently may result in PI (Hoffman, Ciasulli, & Pravikoff, 2017). The total incidence of intraoperative-acquired PIs was recently estimated as high as 66% (Association of Perioperative Registered Nurses [AORN], 2017). A further contributing factor is the worldwide epidemic of morbid obesity, which is also a well-described risk factor for developing PI (Delmore & Ayello, 2017). Often obese patients suffer from medical conditions (i.e., atherosclerosis, arthritis, sleep apnea syndrome, alveolar hypoventilation, urinary stress incontinence, and gastroesophageal reflux disease) that have the potential to increase the risk of PIs, decrease tissue perfusion, and compromise safe positioning even further. For these patients, specialized equipment (e.g., side boards attached to the operating table, extra-wide and extra-long safety straps, ramped position, and adjustable bed/stretchers capable of weight support) is essential.

For many years, correct positioning of surgical patients in an operating room setting has received considerable attention. Surgical practice guidelines are widespread, and availability and training of staff in patient positioning is part of the education curriculum of anesthesia and perioperative nursing staff (AORN, 2017; International Federation of Nurse Anesthetists, 2016). Recommendations aim to avoid inappropriately high and prolonged pressure exposure to body surfaces, which is the underlying principle leading to PI. This can be accomplished by utilizing pressure-reducing mattresses or cushions and appropriate positioning of the patient (Vanderwee, Grypdonck, & Defloor, 2007). Evidence suggests that patient positioning in lateral and prone positions can be difficult because of lack of nurses' and porters' competence, lack of experience to these positions, and lack of available positioning equipment (Sorensen, Kusk, & Grønkvær, 2016). Moore and Webster (2018) performed a Cochrane database systemic review in 2018 on the use of dressings, creams, and other topical agents (e.g., fatty acids and olive oil) on PI-sensitive areas to prevent PI from forming, and found no clear benefit of using these agents and dressings as PI prophylaxis. AORN guidelines suggest the use of positioning devices including supportive padding and pillows for all prominent body parts (AORN, 2017).

In strong contrast to the extensive availability of patient positioning guidelines during surgical

procedures, neither the American Society of Gastroenterology Nurses and Associates or Gastroenterological Nurses College of Australia nor the European Society of Gastroenterology Nurses and Associates mentions patient positioning during gastrointestinal endoscopic procedures in their standards, guidelines, or position statements.

Currently, supine, left lateral, and prone positions are the preferred method of patient positioning during endoscopic procedures. However, these positions can cause nerve injury, skin damage, or compression of tissue or vascular structures, which result in regional ischemia depending on the pressure and nerve injury prevention strategies that are chosen (Welch, 2019). The increased incidence in patients with obesity and associated comorbidities can further increase the risk of these aforementioned injuries.

One of the reported positioning related PIs are petechiae caused by hypoxic damage to endothelia of blood vessels combined with an increased intravenous pressure (National Pressure Ulcer Advisory Panel, 2014). There is a paucity of clinical reports of patients developing PIs during endoscopic procedures. Recently, a case report was published about a patient who developed a PI in the form of a petechial rash during a prolonged (151 minutes) advanced endoscopic procedure (Meeusen, Rogue, & Elson, 2019). This was probably caused by a gel roll pushed too high in the axilla.

During endoscopic procedures, the prone position provides multiple benefits for the proceduralist and anesthetic team including less risk of aspiration, easier access to the oropharynx and esophagus, as well as (Ferreira & Baron, 2007) allowing the endoscopist to directly face the patient. During endoscopic retrograde cholangiopancreatography (ERCP), the ampullary secretions are able to dissipate from the papilla of Vater, aiding biliary cannulation (Mashiana, Jayaraj, Mohan, Ohning, & Adler, 2018).

Endoscopy units face new challenges arising from the increasing numbers of complex and prolonged advanced procedures on patients who have comorbidities and are obese. It would be beneficial for the latter if surgical positioning practice guidelines could be adopted during gastrointestinal endoscopic interventions. The aim of this study was to test whether patient positioning guidelines for surgical procedures in operating rooms are suitable for gastrointestinal endoscopic procedures without negatively impacting safety and procedure duration.

## Methods

Ethics approval was obtained from Metro South Health Human Research Ethics' Committee. This observational feasibility study tested whether patient positioning guidelines, used in operating rooms, can

also be applied to patients undergoing a gastrointestinal endoscopic procedure. We studied the feasibility of three categories of patients: low body mass index (BMI <18.5 kg/m<sup>2</sup>), normal body mass index (BMI 18.5–24.9 kg/m<sup>2</sup>), and high body mass index (BMI >35 kg/m<sup>2</sup>). Three volunteers, one for each BMI category, were recruited among hospital staff with respectively a BMI of 18 (male), 23.5 (female), and 43 kg/m<sup>2</sup> (female). Exclusion criteria were participant's limited range of movement, any sensory impairment, or any presence of pain. The project was discussed with the volunteers and consent was obtained.

The research project comprised two phases. First, the volunteers were positioned in supine, lateral, and prone positions on the operating table according to best practice patient positioning guidelines (Welch, 2019). For the safe positioning, gel mats, gel rolls, pillows, and arm boards were used. Once positioned, the participants were asked for their level of comfort and pictures were taken of the actual positioning. Second, the same guidelines were used to position the volunteers in supine, lateral, and prone positions on the endoscopy patient stretcher (Contour Portare-X with premium trolley mattress, Select Patient Care, Maryborough, Australia). During this second phase, an endoscopist was asked to check for oral access. The position of the volunteers was adjusted based on the endoscopist's requirements while still trying to adhere to the patient positioning guidelines for surgical procedures in operating rooms. Again, level of comfort was assessed, and pictures were taken.

The following PI prevention and nerve injury prevention strategies were applied:

**Supine position.** The head was kept in the neutral position supported with appropriate padding to prevent lateral rotation and pressure alopecia. Both arms were positioned on a padded arm board at an equal level to the operating table and/or tucked in under the patient's own body. Arms were supinated and the palms of the hand faced the body to prevent ulnar nerve injury. Each arm was abducted less than 90° to prevent brachial plexus injury. A pillow placed under the knees prevented hyperextension of the knees and stretching of the peroneal and tibial nerves. The heels were lifted from the mattress by

placing a small gel roll under the lower part of the lower leg. A safety strap placed over the legs 5 cm above the knees prevented involuntary movement of the lower extremities to simulate positioning for surgical procedures.

**Lateral position.** The volunteers' head was kept as much as possible in a neutral position and in line with the spinal cord to prevent stretch injury to the brachial nerve. Special attention was paid to the dependent ear (folding and pressure) and dependent eye (external compression). A small gel roll was placed under the rib cage posterior to the axilla and radial pulse was checked. The dependent leg was flexed while keeping the nondependent leg straight. A pillow was placed between the knees and padding was placed under the volunteers' ankle and foot.

**Prone position.** The volunteers' head was kept as much as possible in a neutral forward position with no significant neck flexion, extension, or rotation and aligned with the cervical neck. Both arms were placed on an arm board, elbows flexed, and the shoulder abducted in an angle less than 90° to prevent stretching of the brachial nerve, and palms were faced downward. Hand and wrist were aligned as per normal practice. A pillow supported the thorax to raise the abdomen and allowed free movement of the diaphragm and facilitated lung expansion. The male genitalia were kept free from pressure by a pelvic roll. Breasts were diverted toward the midline according to the volunteer's comfort preference. A gel roll was placed under the shins to elevate and prevent pressure on the toes.

## Results

The positioning of the three volunteers on the operating table as per positioning guidelines did not cause any problems. However, the level of comfort was rated differently between the BMI categories (Table 1) when comparing patient positions on the operating table and the endoscopy stretcher.

This study demonstrated that it was possible to replicate patient positioning guidelines for surgical procedures to gastrointestinal endoscopic procedures in endoscopy units, except for arm positioning in lateral and prone positions and head positioning in the prone position.

**TABLE 1. Comfort Level of the Volunteers Measured in Three Different Positions**

Body Mass Index (kg/m <sup>2</sup> )	Operating Table			Endoscopy Stretcher		
	Supine	Lateral	Prone	Supine	Lateral	Prone
<18.5	8	8	7	8	8	7
18.5–254.9	10	9	9	10	9	9
>35	9	8	8	9	8	6

In the lateral position for endoscopic procedure positioning, the elbows were flexed, and the arms positioned next to the head pillow. The nondependent elbow and lower arm were supported and kept as much as possible in line with the shoulder.

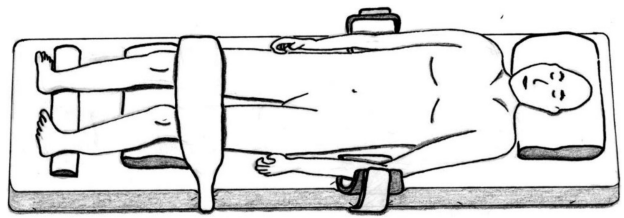
In the prone position, three arm positions were tested with the volunteers, as the use of an arm board was not feasible: first, both arms were positioned next to the body; second, the right arm was bent up, making sure that the angle was less than 90° with the shoulder; and third, both arms were bent up. The volunteers felt most comfortable for endoscopic procedure positioning with the right arm bent up and the left arm next to the body whereas having both arms next to the body felt least comfortable.

For both the low and normal BMI categories, comfort levels were similar on the operating table and the endoscopy stretcher. The obese volunteer reported a significant lower comfort score in the prone position on the endoscopy stretcher compared with the other positions.

From an endoscopist perspective, the prone positioning was the most problematic. Placing the head in a neutral forward position was not feasible, as it limited the endoscopist's access to the mouth. To facilitate mouth access, the head was placed on the edge of the pillow and turned laterally while the head's height was kept in line with the cervical spine.

## Discussion

The intent of this study was to explore the feasibility to transfer the patient positioning guidelines for surgical procedures in operating rooms to gastrointestinal endoscopic procedures. Both supine and lateral positioning did not cause any issues and received similar



**FIGURE 1.** Suggested patient positioning in supine position.

comfort ratings from all our volunteers with a BMI of 18, 23.5 and 43 kg/m<sup>2</sup>.

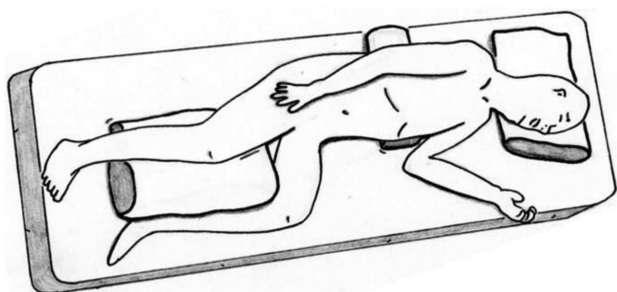
Based on BMI category, several adjustments were necessary to ensure comfortable positioning. In the supine position, volunteers felt comfortably positioned when their head was in line with the cervical spine; and in the supine position, when their ear lobe was aligned with the angle of Louis (Figure 1).

Construction of the endoscopy patient trolley does not allow the use of arm boards. Slight adjustments were made to accommodate the positioning of both arms in supine, lateral, and prone positions. Besides this technical aspect, a protruding arm board would be inconvenient, as it limits access to the mouth and negatively influences the ergonomic posture of the endoscopist and nurse assistant. While not using an arm board, obtaining arm positioning according to pressure and nerve injury prevention guidelines was still feasible (Table 2).

In the left lateral position, the elbow of the dependent arm was flexed, the shoulder abducted, and the palm of the hand faced upward. The right arm could be placed on the right side of the patient or bent and placed on top of the other arm supported by a pillow. In this position, the pillow offered support to the arm, as it was placed as much as possible neutral to the

**TABLE 2.** Suggested Optimal Patient Positioning in Supine During Endoscopic Procedure to Prevent Pressure and Nerve Injuries

Area	Surgical Procedures on Operating Table	Endoscopic Procedure on Patient Stretcher
Head	Neutral position to prevent stretch brachial nerve injury Prevent extreme lateral rotation	Similar as surgical procedures
Arms	Arms next to the body: <ul style="list-style-type: none"> <li>• Draw sheet under patient's torso not under mattress, or</li> <li>• Side rail/frame: elbows padded</li> <li>• Palms face the body to prevent ulnar nerve injury</li> </ul> Arm boards level in the horizontal plane: <ul style="list-style-type: none"> <li>• Board padding equal level to operating table</li> <li>• Arm supinated</li> <li>• Extended &lt;90° angle to prevent brachial plexus injury</li> <li>• Palms facing downward</li> </ul>	Arms next to the body: <ul style="list-style-type: none"> <li>• Side rails of endoscopy trolley up</li> <li>• Palms face the body</li> <li>• Elbows padded, side rail or frame</li> </ul> Arm board: not an option in endoscopy
Legs	<ul style="list-style-type: none"> <li>• Pillow under knees to prevent stretching of the peroneal and tibial nerves</li> <li>• Gel mat under lower leg to lift heels</li> <li>• Leg safety strap:                             <ul style="list-style-type: none"> <li>○ across thighs, 5 cm above knees</li> <li>○ sheet/blanket between strap and skin</li> </ul> </li> </ul>	Similar as surgical procedures



**FIGURE 2.** Suggested patient positioning in lateral position.

shoulder and protected the two arms from tissue and nerve injury (Figure 2).

The thickness of the gel roll, used under the rib cage while in the lateral position, required careful adjustments. A too large gel roll created discomfort for the thorax and a too small gel roll created discomfort for the dependent shoulder. Access to the mouth was not an issue in the lateral position as long as the mouth opening was positioned just over the edge of the pillow. Extra attention needed to be given to the volunteer's dependent ear and eye, as the head may move while an endoscope is inserted or removed by the endoscopist. During colonoscopies, some proceduralists prefer both legs up with knees bend, as it allows them to examine the anus easier, especially for obese patients. Also, this position may be more stable during the procedure, while others prefer the nondependent right leg over the dependent left leg for the same reason (Table 3).

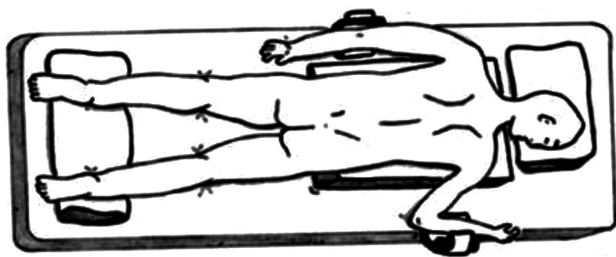
The prone positioning of the volunteers was the most challenging one. Absence of arm boards and the absolute need for easy access to the mouth required creative solutions. Our volunteers preferred the elbow of the right arm flexed and the shoulder abducted with the

palm of the hand facing downward and at the height of the shoulder line while the left arm was positioned next to the body with the palm of the hand facing upward. This position also causes the least strain and compression of the brachial plexus (Cooper, Jenkins, Bready, & Rockwood, 1988; Sawyer, Richmond, Hickey, & Jarratt, 2000; Winfree & Kline, 2005). Easy access to an intravenous cannula can be obtained either in the right hand/arm in case the endoscopist is performing the procedure and administering the sedation at the same time or, in case an anesthesia team is involved, in the left hand/arm to avoid obstructing or hindering the endoscopist working area. The positioning of the breasts while in the prone position is debatable: lateral or to the midline. Our female obese volunteer was very convincing of the higher degree of comfort for the breasts to be positioned to the midline.

Positioning of the head while in the prone position required even more attention (Figure 3). To allow oral access, it was impossible to leave the head in a neutral forward position as it had to be rotated to the right, which can cause strain on the brachial plexus. However, the volunteers experienced this position as comfortable depending on the angle of the flexed arm. A smaller angle of abduction of the arm was rated as more comfortable. The left arm was positioned next to the body and attention needed to be paid to the neutral positioning of the wrist. Although our endoscopy stretcher was wide enough for our obese volunteer with the elbow of one arm flexed and shoulder abducted, evidently more space was required. Although obese patients might fit on the normal standardized stretcher, an extra wide stretcher is highly recommended for those patients in the prone position.

**TABLE 3.** Suggested Optimal Patient Positioning in Lateral Position During an Endoscopic Procedure to Prevent Pressure and Nerve Injuries

Area	Surgical Procedures on Operating Table	Endoscopic Procedure on Patient Stretcher
Head	Neutral position, in-line with cervical spine Protect dependent ear from folding and pressure Protect dependent eye from external compression	Similar as surgical procedures, and • Mouth opening positioned on edge of the gel ring or gel horse shoe
Arms	Axilla roll under the rib cage, posterior to the axilla to prevent compression of the vascular axilla and venous engorgement Dependent arm secured on a padded arm board (level in the horizontal plane with the operating table) in front of the patient levelled with the shoulder height, hand palm facing downward Elbow of the nondependent arm flexed, and arm placed on a separate padded arm board, hand palm facing upward	Axilla roll similar as surgical procedures, and • Elbow of the dependent arm flexed, shoulder limited abduction with hand positioned at shoulder height and hand palm facing upward • Non-dependent arm: ○ On top of patient's side with padding of the elbow and hand palm facing downward, <i>or</i> ○ Elbow flexed and arm placed on top of other arm, levelled with shoulder height and padding under elbow and lower arm, hand slightly lower than dependent arm and hand palm facing downward
Legs	Dependent leg flexed Nondependent leg straight Padding under nondependent knee, ankle, and foot to prevent compression of the common peroneal nerve	• Similar as surgical procedures, <i>or</i> • Both legs up with bent knees and padding between the knees, <i>or</i> • The nondependent leg slightly over the dependent leg with padding between the legs.



**FIGURE 3.** Suggested patient positioning in prone position.

A modified prone position, the so-called swimmer’s position, is often used during ERCP procedures. In this position, the left arm is positioned next to the body, the elbow of the right arm is flexed, and the shoulder is abducted well beyond a 90° angle with the shoulder. Together with the volunteers and the endoscopist, we explored whether adjustments could be made to the “swimmer’s” position so that the patient position would comply with pressure and nerve injury guidelines. The most comfortable option required placing pillows under the right side of the volunteers’ thorax and abdomen, creating a prone 30° lateral tilt position, with the left arm next to the body, the elbow of the right arm flexed,

the shoulder limited abducted so that the elbow is still below shoulder height, the left leg straight, and the right leg flexed with a pillow underneath the knee for support (Table 4).

Although many endoscopists still regard the prone positioning of the patient during ERCP superior to the supine positioning of the patient (Batheja, Harrison, Das, Engel, & Crowell, 2013; Mashiana et al., 2018; Terruzzi, Radaelli, Meucci, & Minoli, 2005), prospective studies with an adequate sample size are not yet available to support this and it is not clear whether patient positioning is a leading factor to successful completion of an ERCP at all (Maydeo & Patil, 2018). From an anesthesia perspective, anesthetized and paralyzed obese patients in the prone position would be favorited over the supine position because when assuring free abdominal movement, lung volume, compliance, and oxygenation increase and therefore do not seem to have any adverse effects on pulmonary function in obese patients. In the supine position, those patients have marked reductions in lung volume, alterations in lung mechanics (low compliance and high resistance), and moderate hypoxemia (Hartley & Baitch, 2015; Pelosi et al., 1996).

**TABLE 4.** Suggested Optimal Patient Positioning in Prone During an Endoscopic Procedure to Prevent Pressure and Nerve Injuries

Area	Surgical Procedures on Operating Table	Endoscopic Procedure on Patient Stretcher
Head	Eyes protected to prevent corneal abrasion and ocular damage Cervical neck alignment Weight borne by bony structures (padding on forehead and chin) Head in neutral forward position, avoid significant neck flexion, extension, or rotation to prevent brachial plexus trunk injury	Similar as surgical procedures, but <ul style="list-style-type: none"> <li>• Head rotated to right and mouth opening just over the edge of the pillow while preventing brachial plexus overstretching</li> </ul>
Arms	Hands and wrists in normal alignment Padding of elbows to prevent ulnar nerve injury at the coronoid tubercle At the sides, <i>or</i> Arm boards: <ul style="list-style-type: none"> <li>○ shoulder abduction &lt;90° to prevent overstretching of the brachial plexus</li> <li>○ flexed elbow &gt;90° to prevent stretch of brachial nerve</li> <li>○ palms facing downward to prevent ulnar nerve injury</li> <li>○ arms placed below the height of the torso and in contralateral head rotation to prevent injury to the brachial plexus trunk</li> </ul>	<ul style="list-style-type: none"> <li>• Left arm next to the body:                             <ul style="list-style-type: none"> <li>○ padding of elbow to prevent ulnar nerve injury at the coronoid tubercle</li> <li>○ hand palm facing upward to prevent ulnar nerve injury</li> </ul> </li> <li>• Right arm:                             <ul style="list-style-type: none"> <li>○ flexed elbow &gt;90° to prevent stretch of brachial nerve</li> <li>○ shoulder abduction till hand is at same height as shoulder</li> <li>○ arm in the horizontal plane level with the shoulder</li> <li>○ hand palm facing downward to prevent ulnar nerve injury</li> </ul> </li> </ul>
Thorax/abdomen	Pillow under thorax and pelvis, <i>or</i> Two large chest rolls (clavicle–iliac crest) to raise abdomen and thorax Divert the breasts toward the midline Male genitalia free from pressure	<ul style="list-style-type: none"> <li>• Prone 30° left lateral tilt</li> <li>• Wedge pillow under thorax</li> <li>• Wedge pillow under pelvis</li> <li>• Divert the breasts toward the midline</li> <li>• Male genitalia free from pressure</li> </ul>
Legs	Toes elevated and padding under shins	Similar, but including: <ul style="list-style-type: none"> <li>• Left leg straight</li> <li>• Right leg flexed with a pillow underneath the knee to prevent injury to the peroneal nerve</li> </ul>

## Implications for Practice

It is crucial to establish positioning guidelines for endoscopic procedures in supine, prone, and lateral positions. These new patient positioning guidelines during gastrointestinal endoscopic procedures should become part of national endoscopy practice standards and the education curriculum of endoscopy nurses. The current guidelines for patient positioning during surgical procedures in operating rooms could be used as a reference. Research is needed with actual patients during real endoscopic procedures. Further research is also needed to find a method to determine the optimal size of the gel roll for the rib cage in the lateral position for each patient.

## Conclusions

In conclusion, besides minor adjustments, we were able to replicate the positioning guidelines for surgical procedures to gastrointestinal endoscopic procedures and adhere to the pressure and nerve injury prevention guidelines. However, a review and adjustment of the “swimmer’s” position is recommended, as this does not comply with the patient positioning guidelines. Due to specific requirements of oral access of the patient by the endoscopist, specific positioning equipment (gel rolls/mats) should be developed. ✪

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