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Chapter

Anesthesia in Plastic Surgery: Intersurgical I-gel Placement in a Prone Position

*Judith Adrienne Deutsch, Kata Šakić, Dinko Bagatin,
Johann Nemrava and Tomica Bagatin*

Abstract

Anesthesia is a specialization which in past history has branched off of surgery. It needs to be very creative in its delivery, in order to accommodate the many operating positions, needed by the surgeon. The patient positions must also be safe and adequate for proper ventilation, throughout the operative procedure. There are times when multiple positions must be used, turning the patient over, even several times. Careful planning and team discussions prior to an operation are absolutely necessary, to form anesthetic and operative plans. The aim of the supraglottic airway device (Intersurgical i-gel) prone position induction method is to describe, detail and present its safe efficacy for certain planned operative procedures. Patient fasting preparation is a must, nil by mouth for 8 h. This method and sequence alleviates the use of muscle relaxants for patient rotation. This increases patient safety by keeping muscle tone normal, reduced drug use, minimizing rotation of the patient, and reduces possible injury of patient and among staff involved in rotating. Some may say induction in the prone position may be unsafe due to aspiration risks, but knowing anatomy and gravitational physics, in the event of any secretions projected, they will project forwards onto the operating table (through the gastric port of the i-gel), not into the tracheal area. This similar technique and principle are seen and used for the recovery position, to aid in free drainage of fluid from within the oral cavity. The method is used for a variety of operations worldwide and introduced in 2018 at Poliklinika Bagatin (PB). Approximately, 80 prone position inductions or 10% of all general anesthetics are performed every year at PB. More than 240 anesthetized patients in the prone position with an i-gel have used this method, since it was introduced. All have been with excellent results, minimal risk and appropriate ventilation of patients. I-gel placement in prone position was successful everytime. This method is advantageous to avoid multiple rotations of patients and avoid the use of muscle relaxants, otherwise used, with classic endotracheal intubation methods. The exact process will be discussed in more detail and described within the chapter.

Keywords: i-gel, prone position, patient safety, reduced rotation, faster preparation, esthetic plastic procedures, liposuction

1. Introduction

Creative anesthesia and patient safety are the goals of accommodating surgeons and providing superior anesthesia. The entire team have the same focus, to complete an operation in the best possible manner and with exceptional results. Plastic surgery has high expectations for perfect results. There are numerous operative procedures being offered in esthetic plastic surgery, requiring various forms of anesthesia, in various positions. The anesthesia provided may be local, local with sedation (local potentiated), regional blocks and general. The choice of delivery can involve the patient's desires, but must be a safe method, in order to maximize comfort during the procedure. Some procedures may last several hours, and in these cases a balance between the patient's desires, comfort and safety must be weighed out, for the most optimal choice. Preoperative consultations and plans are discussed between the patient, surgeon, anesthesiologist and the entire team, to define the type of optimal anesthesia to be delivered, as well as surgical technicalities and specifics (instruments, devices, sutures) needed.

Preoperative preparations with the anesthesiologist can be challenging with patients who have specific disorders, chronic disease, previous operations, increased age, mobility issues, various drug therapies being taken, allergies and more. Preoperative testing, thromboprophylaxis, intraoperative active body warming, hydration are among other vitally important features of preoperative and intraoperative preparations that need to be considered.

Today many patients undergoing anesthesia, wish to complete as much as possible, while under one anesthesia. This needs to be assessed by both the surgeon and anesthesiologist for safety, logistics and feasibility. At times, a combination of operations, two body regions, can be performed. This significantly increases the duration of the anesthesia and operation. In some cases, this may not be possible, and a recommendation is made for the procedures to be performed separately.

The vast offerings of procedures in esthetic plastic surgery most commonly include: total body liposuction, abdominoplasty, breast enhancement, breast reduction, breast lift, areolar corrections, septorhinoplasty, face lifting, lip lift, eyebrow lift, blepharoplasty, auricular corrections, chin implants, and lipofilling.

Many individual clinics may be specialized in other specific types of esthetic plastic operations, offering even more procedures, not mentioned here. However, the list is comprised of the more common available procedures worldwide and what is offered at Poliklinika Bagatin (PB). Furthermore, these various procedures can involve different positions, which are challenging for the anesthesiologist and their team. Therefore, good preparation is key. The prone position can be a safe and great alternative induction position, reducing patient rotations, avoiding the use of muscle relaxants and increasing patient and staff safety.

2. Methods and procedures

A deeper understanding of the methods and procedures, used worldwide and at PB, using prone position induction will be described. A detailed refresher of anatomy is recommended, for the anatomical placement differences between the endotracheal (ET) tube and i-gel intubation devices.

Anatomy of the airway is vitally important and needs to be protected, during any procedure. The pharynx is comprised of the nasopharynx, oropharynx and

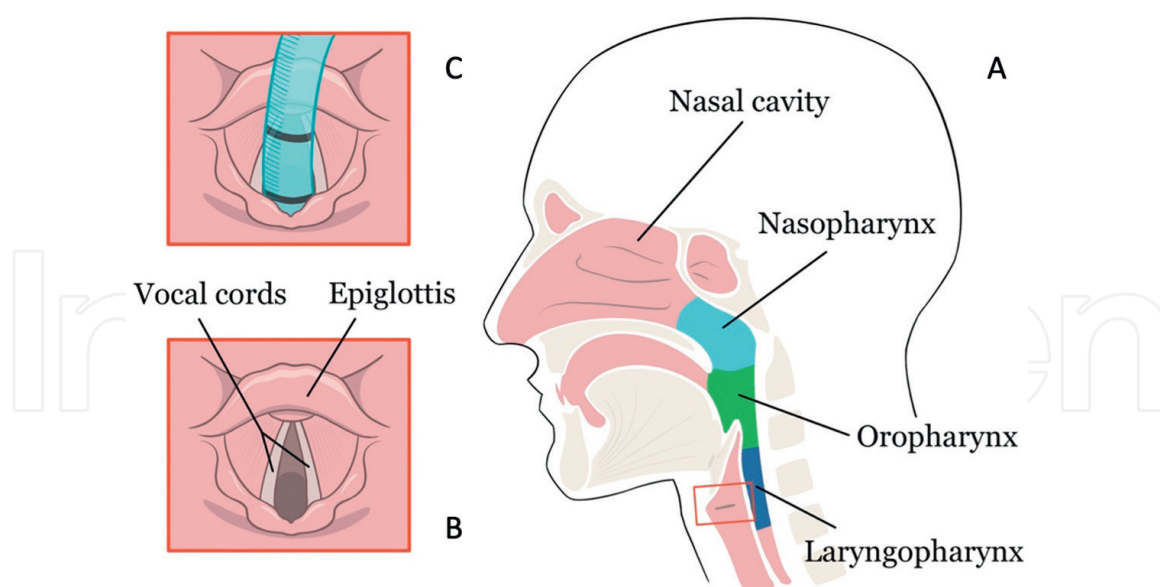


Figure 1.
(A) Sagittal plane anatomy head; (B) vocal chords, epiglottis image without ET tube; (C) image of ET tube in place following intubation.

laryngopharynx (**Figure 1A**) [1, 2]. The upper section, nasopharynx connects the nasal passages to the airway. The middle section, the oropharynx forms the mouth. While the lower portion, the laryngopharynx is the area with the entrance into the trachea passing the vocal chords (**Figure 1B**) [1, 2].

The process of intubation can comprise of an endotracheal tube, which is the most secure method of separating the airway from the gastrointestinal passages, or the use of laryngeal devices, which adequately ventilate but do not separate these passages (**Figure 2A** and **B**) [1, 2]. Both methods require complete sedation of the patient and placement onto an anesthetic machine for controlled or assisted ventilation. Standard monitoring (blood pressure, ECG, and pulse oximetry) should always be used, regardless of the anesthesia type and method chosen. Placement onto an anesthetic machine gives more diverse information, such as end tidal CO₂, tidal volume, respiratory rate, various airway pressures and concentrations of anesthetic gases. Even more advanced monitoring (arterial pressures) can be used, depending on the complexity and duration of the procedure being performed, more often used within the hospital setting rather than outpatient clinics.

Other methods used at PB, such as local, local with added sedation (local potentiation) and regional blocks are used with mask or nasal oxygen tubing in spontaneously breathing patients. The various anesthetic methods can be used on their own or in combination, for optimum pain control coverage during and after procedures. Both surgeons and anesthesiologists can perform the local and regional anesthetic methods. However, intubation requires specific training and skills, and is usually reserved for anesthesiologists.

Placement of the ET tube involves the use of a laryngoscope, to move away soft tissues and the base of the tongue, gently lifting the epiglottis, in order to visualize the entrance into the trachea (**Figure 1B**) [1, 2]. The ET tube is then advanced, with care, into the trachea, passing the vocal cords (**Figure 1C**) [1, 2]. Fixation and final placement of the ET tube is confirmed by chest auscultation hearing equal breath sounds on either side of the chest and then securing it with medical tape or a tie.

Supine Position

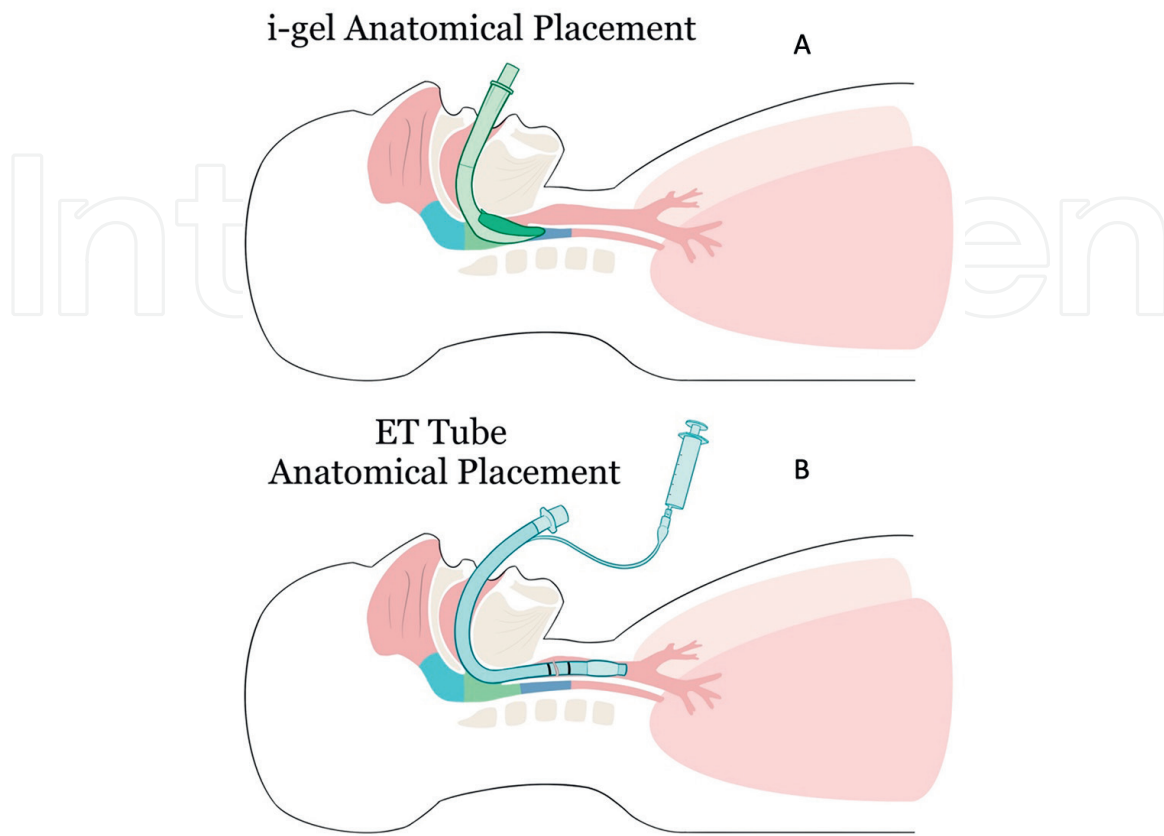


Figure 2.
(A) *i-gel* following intubation; (B) ET tube following intubation.

Proper auscultation and fixation prevent accidental one lung ventilation and possible barotrauma (**Figure 2B**) [1, 2].

There are various generations of laryngeal devices available, however all have similar principles in their placement, with a variation in fixation of position (with or without a cuff). They all cover the entrance into the trachea and the esophagus. They do not separate or prevent spillage over into the tracheal area, which can cause concerns, potentially causing aspiration of fluids into the respiratory system (**Figure 2A**) [1, 2]. However, proper patient preparation can reduce spillage into this area.

The *i-gel* is a unique device, which is elegantly simple and requires no balloon inflation (**Figure 3**) [3].

Assistance to perform a mandibular thrust aids in the opening of the mouth. The placement of the *i-gel* follows the curvature of the tongue and the device is advanced into position after passing the tongue base. There usually is a final jolt, felt in the hand when the *i-gel* reaches its final snug position, felt similarly in supine and prone position placement. Thereafter it can be taped or tied to remain in position. The final choice, of which intubation method and device will be used, is decided by the anesthesiologist.

Created in 2007, the *i-gel* is a versatile device capable of providing safe effective anesthesia in fasted patients, as mentioned earlier. The various operations it can be used for are for those lasting up to 4 h, ideally for procedures of the neck down and used with caution involving abdominal distention and pressures [3]. Prone position *i-gel* use adds a new dimension of possibilities for additional procedures on the backside of patients. The list of possible procedures can span from esthetic plastic



Figure 3.
Intersurgical i-gel laryngeal device (flexibility).

to abdominal, vascular, orthopedic, urology, gynecology, fiberoptic guidance, and numerous beneficial pediatric uses [3]. As with any anesthetic method complications can always arise. They can be of various intensities, from mild to severe, and these are mentioned further into the chapter. The anesthesiologist must weigh out the risks and benefits prior to every anesthesia they perform.

3. Comparison of supine and prone intubations

The supine position, laying flat on the back with the head placed in a neutral position, is the most common intubating position. The patient, following intubation with either an ET tube or laryngeal device, can be moved into desired positions, to facilitate the operative areas. Caution with laryngeal device use, as some movements may cause displacement.

When performing a supine induction with an ET tube, a hypnotic, an opiate, and a muscle relaxant (paralytic) are given to aid in its placement. This completely relaxes (paralyzes) all the muscles in the body. In contrast, a supine induction with an i-gel requires just a hypnotic and opiates. Following intubation, the patient can then be placed into desired positions, extreme caution must be used not to cause injury, when the patient is fully relaxed and paralyzed.

The anesthesiologist is the voice of the team and sets the start of patient positioning and movements. All movements must be thoroughly planned and synchronized. This ensures that everyone involved moves at the same time, to avoid injuries.

Prone position induction begins with the patient placing themselves onto the operating table, in the most comfortable head and body position. A good visual image is, as if they are sunbathing (**Figure 4**).



Figure 4.
Patient oxygenation in prone position. Patient in prone position with i-gel.

Their hands and arms are placed in extensions, in a somewhat relaxed forwards position. An added benefit of this method, is that the patient positions themselves, avoiding pressure points that can cause injury. This is especially important, when lying in position for a greater length of time. The induction can begin, when the patient has found their most comfortable body and head position. Another advantage is determining can they tolerate such a position. High BMI patients may have difficulty in ventilation but this can be visualized prior to anesthesia. Finding their most comfortable position is key. The operating table can be adjusted to help further. At PB, patients with an increased BMI are routine. Extreme BMI (over 40 kg/m^2) patients are advised beforehand, to reduce weight and are guided by a nutritionist to prepare them, for future procedures.

Prone positioning induction, following patient position, intravenous access (can be placed earlier) and monitoring attachment, begins with preoxygenation. A mask with flowing oxygen is placed near the mouth of the patient, not too close to the mouth as to cause discomfort or stress. A hypnotic and an opiate drug are used. When the patient has lost eyelash reflexes and is asleep, the laryngeal device (i-gel) can be placed. The anesthetic technician assists in a gentle mandibular thrust, in order to open the mouth, while the anesthesiologist places the device into the pharynx. The use of your index finger to gently move the tongue away, if needed, to aid in i-gel placement is helpful. The sensation of the device „sitting into position“ is similar as when applying the device in the supine position. Attachment to the anesthetic

machine, parameters and quality check of ventilation are the same. Often fixation of the i-gel is not necessary in the prone position, as the position itself prevents the i-gel displacement. The eyes, ears, and neck flexion/extension need to be checked. The operating table is then tilted up to 10–20° angle, in an anti-Trendelenburg position (head slightly higher than feet). This reduces potential secretions draining from the gastrointestinal tract. In the event of visible drooling, gentle suctioning around, through the gastric port and the main i-gel channel can be done. Remember that all patients using this technique need to be well fasted. It is also advisable to have a stretcher bed near by, in the event you need to turn the patient quickly over onto their back, for any reason.

The avoidance of muscle relaxants (paralytics), reduced rotations, better patient and staff protection are some of the reasons why many centers worldwide, and PB, are using this prone method, for planned and well fasted patients, in selected operations. At PB, only the Intersurgical i-gel is used for the prone position method.

Magnetic resonance imaging (MRI) can show anatomical coverage in a prone position, with the head turned to the right side (**Figure 5**, Courtesy of Special Hospital AGRAM, Zagreb, Croatia) [4].

The imaging done in this position, may have been the first of its kind. When compared to supine MRI imaging, the anatomy is similar. Unfortunately, due to the limitations of the radio frequency (RF) head coil, an image with a i-gel in place, in

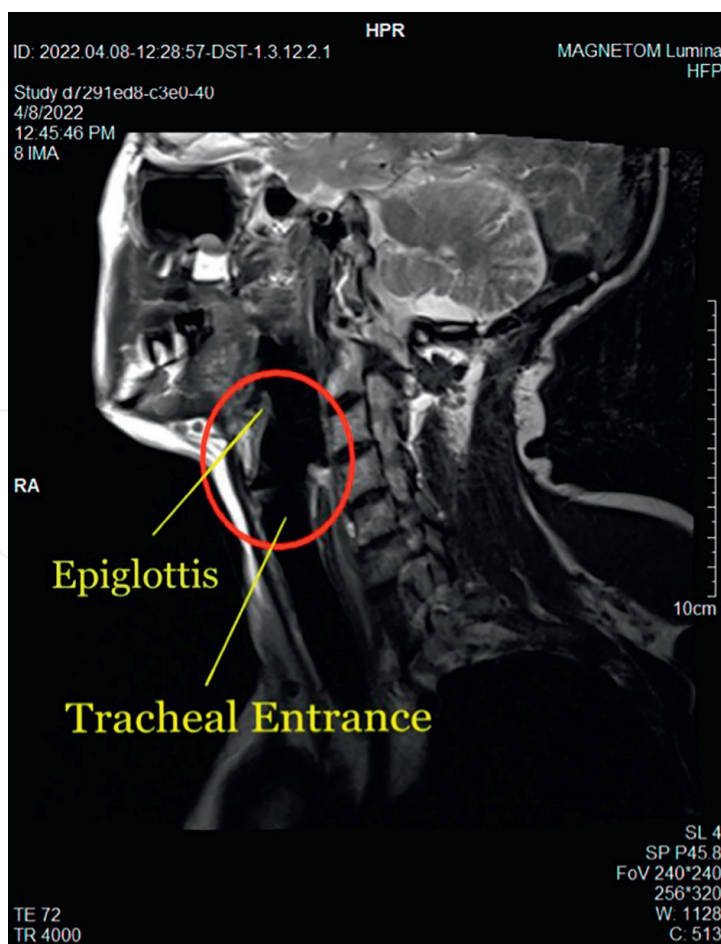


Figure 5. MRI image of prone position with head turned to the right side (courtesy of Special Hospital AGRAM, Zagreb, Croatia).

a prone position, was unattainable for safety reasons. Limited head and i-gel device space, in a prone position, were the main factors.

4. Possible complications of prone position

The prone position, as with any intubating position, can have various complications [5–9]. The most common complications can be secretional aspiration, air leakage—improper fit of the i-gel device, increased abdominal and thoracic pressures, tongue swelling, tongue cyanosis, and hypoglossal nerve injury [10–15]. Mentioned earlier, is the importance of a patient being well fasted, to avoid obvious food aspirational risks. Secretions in a fasted patient can also cause aspiration, but to a reduced effect. This can be avoided to gently aspirate around and through the i-gel, if present.

Air leakage around the i-gel can occur, reducing tidal volume and compromising ventilation, if the i-gel is too small. A properly sized i-gel can alleviate this issue (sizing by weight on packaging).

Heavy BMI patients can have ventilation difficulty, due to increased abdominal and thoracic pressures. The anti-Trendelenburg position can be increased to reduce these pressures and aid in better ventilation. An added benefit, of the patient positioning themselves, is the ability to observe position tolerance, while they are still awake. For the increased BMI patients, in prone, the increased operation table adjustment was enough, to normalize the higher thoracic pressures, to have adequate ventilation throughout the procedures.

Patients with gastroesophageal reflux disease (GERD) have been done successfully, in prone with the i-gel during the first phase of a liposuction procedure at PB. However, upon rotation into a supine position they are intubated with an endotracheal tube, for the remainder of the operation. This is also true for planned extended liposuction with abdominoplasty. Following rotation into supine, a switch is made from i-gel to ET, with the addition of an urinary catheter to monitor output, as well as hydration.

Continuous suctioning through the i-gel port is not recommended. This could have an effect on ventilation values and the patient's attempts to breath spontaneously. Patients can and should be encouraged to breath spontaneously while in the prone position. This is also an effective method, for heavy BMI patients, to reduce abdominal and thoracic pressures.

Intersurgical the manufacturer of the i-gel device recommends a maximum 4 h of use [3]. This is mainly due to pressure sores developing in the parynx where the i-gel comes into direct contact with the mucosa and base of the tongue. With prone position the i-gel pressure points are in different areas as compared to the supine position. Therefore, an extended length of usage time is possible, up to an additional 2–3 h, after rotating from prone to supine. At PB, this is done often and with minimal or no issues. There have been a few incidences of regional numbness of the tongue, minor swelling, throat soreness, which resolved in a few days or weeks, without permanent damage, and with no special interventions necessary. In some instances, a low dose of dexamethasone (8 mg) was sufficient to reduce swelling, if present. The patients were explained the causative factor and followed up, with all of them making a full recovery of these minor injuries. There have been documented complications, at other institutions, with laryngeal devices of premolar toothloss, tongue cyanosis and hypoglossal nerve injury [11, 14, 15]. However, at PB these more serious complications have not been observed. The majority of these serious complications involved classic laryngeal mask devices, not the i-gel, since the i-gel was created in 2007 [3].

All in all, PB has had great success using the prone position induction method, for over 3 years, with minimal complications. As with all induction methods, anesthesiologists must have a back up plan and always be prepared for the unexpected.

5. Induction for esthetic plastic procedures

At PB a variety of esthetic plastic procedures are available. Some larger operations requiring general anesthesia, may rotate patients several times, while for others only one patient position is necessary. For operations involving the head, neck, ears, face an ET intubating method is used, while for breast augmentation, reduction and lifting a laryngeal device (i-gel) is preferred. For some procedures, a combination of both can be used. The final choice lies in the decision of the anesthesiologist, however, for longer operative times, an ET tube is preferred [5, 6].

Since 2019, at Poliklinika Bagatin 756 various procedures have been performed during the pandemic era (**Table 1**).

Computer simulations using the VECTRA XT 3D, aid in displaying visual results of some postoperative procedures, before and after imaging. The VECTRA captures body images, 360° measurements and imaging, taking only a few seconds to produce a simulated image [16–18]. This is an added benefit where reconstructive plans can be worked out in detail with the surgeon and patient before the actual operation.

During the pandemic era, this was a challenging time. New protocols and safety precautions had to be created and followed. More online consultations were performed, followed by shorter in person visits, to reduce exposure risk. Masks, sanitizing gel, body temperature control, ozone devices, constant cleaning of offices, examination and operating rooms were the norm. Paradoxically, there was an increased interest in esthetic plastic procedures during this period. Perhaps, this was due to working from home. Patients were able to avoid taking off sick days for procedures, recovery was in the privacy of their home and not as noticeable, as it would be having to return to their workplace. The percentages of the most common procedures performed at Poliklinika Bagatin, during the pandemic era, are presented in **Figure 6**.

As seen from the table and graph, the prone position is used for total body liposuction (with or without abdominoplasty). The operations usually begin on the backside of the patient and following completion, the patients are turned around to complete

Total body liposuction	45
Liposuction + Abdominoplasty,	32
Abdominoplasty	7
Breast augmentation (all types)	304
Septorhinoplasty	218
Ritidectomy (face lifting)	30
Other procedures	120
Total operations	756

Table 1.
Esthetic plastic operative procedures poliklinika bagatin from November 2019 to January 2022 (the pandemic era).

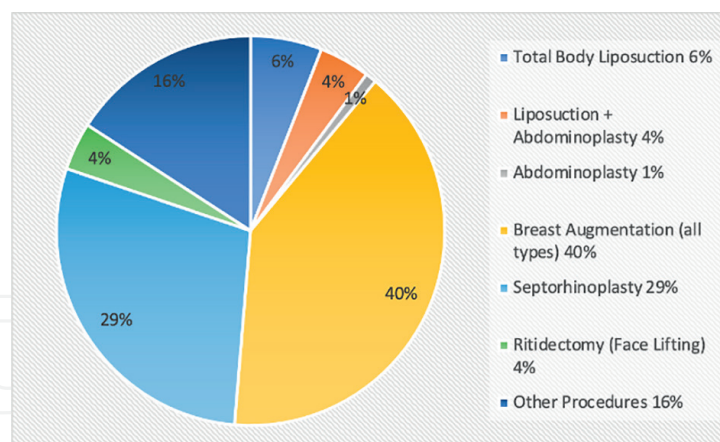


Figure 6.
Esthetic plastic operative procedures Poliklinika Bagatin during the pandemic era.

the frontside [19, 20]. At this point, following rotation, a decision will be made to the length of the procedure, whether to keep the i-gel in place for the remainder of the operation, or if an ET tube will be placed. If abdominoplasty is planned, an ET tube is placed (the procedure can be lengthy and last more than 4 h). However, if only liposuction is planned, often the i-gel will remain, as the procedure will last up to 2 h more in the new supine position.

Other uses of the i-gel are with breast augmentation procedures, in estimated operative times up to 4 h. If more time is expected, such as with reduction, lifting and lipofilling, then an ET tube is preferred.

Ritidectomy (Face Lifting), septorhinoplasty, cleft lip corrections, palatal expansion, and various dental procedures require intubation with an ET tube.

As a private clinic, PB needs to provide safe anesthesia and surgery at a highest level. Providing a method without the use of muscle relaxants reduces recovery time, reduces muscle fatigue, and helps patients be prepared for discharge. However, in the event they are not ready, other arrangements are in place to care for them until they can safely go home [7].

6. Conclusion

This chapter reflects on a successful 3 year period, at PB, in which the prone position induction was introduced in 2018, for certain esthetic plastic procedures. The clinic has benefited from easier patient preparation, less patient rotation, reduced muscle relaxant (paralytic) drug use and increased safety for patients and staff.

Some clinicians may not believe in the i-gel as a reliable laryngeal device, and may reserve its use only for emergencies. However, the i-gel is a unique and extremely useful device, with a wider scope of delivery, that has changed anaesthesia today [21]. This chapter explains that the i-gel can be used in uncommon induction positions safely. Future analysis of pulmonary pressure differences using the i-gel in prone and supine position, in the same patient after rotation, are being gathered. Also, a study to compare tongue complications in prone and supine, with an i-gel in situ for 4 h is being developed. There are numerous fascinating aspects to observe and present with this method of intubation. Its use has been very reliable and valuable [9]. However, most importantly are the patient, staff and clinic benefits, using this safe and secure

method, for a variety of procedures. PB finds the i-gel a remarkable and useful device, and will continue to use it and the prone position induction method, for years to come, after their successful introduction.

7. Discussion

After researching the use of i-gel in the prone position, we have found its usefulness in Japan, India, Germany, Netherlands, Denmark, Spain, Portugal, Poland, Croatia and even sporadic uses in the UK. A special thank you to all the colleagues who gave feedback about the use of i-gel in prone position. Initial experiences with this method, I personally observed in Porto, Portugal at the CICA Centar (a beautifully organized 1 day ambulatory surgery clinic) in 2014, and its use was routine. This method used Worldwide is intended for shorter duration procedures performed dorsally on the back, arms, legs ideally for any back side region. As asked by one editor, could it be used for spinal operations? Indeed, potentially it could be used for minor spinal procedures which are shorter in length, and not expected to develop serious complications intraoperatively, which would require converting to a deeper and more secure form of airway control and anesthesia. In the Netherlands this method of prone i-gel use is used for selected spinal operations since 2013 [22]. It is an excellent method to consider, for example, in lipoma excision, pilonidal sinus, achilles tendon heel repair, prone jackknife position for hemorrhoids, certain radiological exams or total body liposuction. Anesthesiologists are constantly faced with risks, never knowing when something may go awry. In general, being ultra prepared and choosing the least risky route, with patient safety as a leading determinate, are the mainstays of anesthetics. Throughout history most innovative new devices, techniques, methods, etc.... have been created to simplify and make our work easier. The technique, for PB, has been shown to be safe, reliable and a valuable alternative to the classic intubation and rotational methods being used. Regardless of the method used, patient's safety should come first. Remember, there can be many routes to get to our final destination, but get there safely. The ultimate choice lies with the anesthesiologist.

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Author details

Judith Adrienne Deutsch^{1*}, Kata Šakić^{2,3}, Dinko Bagatin⁴, Johann Nemrava⁴
and Tomica Bagatin⁵

1 Anaesthesiology, Resuscitation and Intensive Care, Polyclinic Bagatin, Croatia

2 Faculty of Dental Medicine and Health Osijek, Anaesthesiology, Resuscitation and Intensive Care, University of Osijek, Croatia


3 School of Medicine University of Zagreb, Polyclinic Bagatin, Croatia

4 Faculty of Dental Medicine and Health Osijek, General and Plastic Reconstructive and Aesthetic Surgery, University of Osijek, Polyclinic Bagatin, Croatia

5 Faculty of Dental Medicine and Health Osijek, University of Osijek, Polyclinic Bagatin, Croatia

*Address all correspondence to: judita10000@gmail.com

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