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REVIEW ARTICLE

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Different tonsillectomy techniques in Egypt: advantages and disadvantages — experience and review of literature

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Abstract

The debate about which surgical technique for tonsillectomy could be superior over another is continuous. Tonsillectomy techniques are classified into cold and hot procedures. In cold techniques, no heat is used; they include dissection, guillotine, microdebrider, harmonic scalpel, and cryosurgery. Hot techniques include electrocautery, coblation, radio frequency, and laser. In Egypt, the used methods are cold dissection, electrocautery, cold dissection with electrocautery hemostasis, coblation, and less commonly laser. In this study, we described the advantages and disadvantages of each technique.

Hot techniques have shorter operative time and less intraoperative bleeding, while cold dissection technique has less postoperative pain and less postoperative complications especially secondary hemorrhage, with more rapid wound healing. However, coblation technique may have less pain in the first few hours postoperatively relative to cold technique. Electrocautery technique is the most painful method with delayed wound healing. Laser technique is nearly equivalent to electrocautery with slightly less pain. Cold dissection technique is less costly when compared to other techniques. Family satisfaction after tonsillectomy is dependent mainly on less postoperative pain and rapid recovery.

Cold dissection is still considered the gold standard technique. Caution should be taken on using hot techniques especially when used for dissection, and the trainee surgeons should become familiar with cold dissection before shifting to other tonsillectomy techniques. From this study, we can say that hot techniques should not be used except after mastering the cold dissection tonsillectomy; also, the new advanced techniques can be reserved for high-risk patients such as having bleeding disorders.

Keywords Tonsillectomy, Cold dissection, Coblation tonsillectomy, Electrocautery tonsillectomy, Laser tonsillectomy

Introduction

Tonsillectomy is considered one of the commonest operations in the field of otolaryngology. It has two main indications either recurrent throat infections according to Paradise criteria or tonsillar hypertrophy causing sleep-disordered breathing (SDB) [1]. Although normal tonsils provide immune protection, unhealthy tonsils are usually less functioning. Infected tonsils may be associated with decreased antibody formation and even decreased antigen transport [2]. Despite tonsillectomy is nowadays

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performed less frequent than it was done before, it is still a common pediatric surgical procedure performed anywhere in the world. In 1959, 1.4 million tonsillectomies were done in the USA [3]. Recently, this number has been dropped to about 530,000 procedures per year [2]. As the procedure is a common practice, it represents a major concern for the otolaryngologists.

Tonsillectomy can be done by different methods; a surgeon usually prefers a particular technique over another according to his training, experience, and available facilities. In the USA, the most used method is the hot extracapsular technique in which the tonsils are excised with monopolar cautery [4]. In the UK, cold dissection technique with the aid of bipolar diathermy for hemostasis is the most popular method (35% of all), followed by bipolar diathermy for both dissection and hemostasis (30% of all), while other techniques include monopolar electrosurgery, harmonic scalpel, laser dissection, and coblation tonsillectomy (35% of all) [5]. In developing countries, cold dissection technique with ties for hemostasis is the most widely used method [3]. Every technique has its advantages and disadvantages. However, technological inventions in tonsillectomy should focus on the following: safety, less intraoperative bleeding, less operative time, less postoperative pain, rapid wound healing, and affordability [3, 6]. Despite the surgical revolutions in techniques, the debates continue about the best surgical procedure for tonsil removal. The aim of this study was to discuss the different popular surgical techniques of tonsillectomy which are used in our country and to show the advantages and disadvantages of every technique.

The commonly used techniques

Tonsillectomy techniques are classified into cold and hot procedures. In cold techniques, no heat is used; they include dissection, guillotine, microdebrider, harmonic scalpel, and cryosurgery. Hot techniques include electrocautery, coblation, radio frequency, and laser [1, 3]. In our country, the used methods are cold dissection, electrocautery, cold dissection with electrocautery hemostasis, coblation, and less commonly laser.

The patients' settings and anesthesia attainment are similar for all tonsillectomy techniques. The patient is usually placed in supine position; the operating table should be straightened flat with oral endotracheal intubation. The endotracheal tube should be placed in the midline [7]. The patient's head is positioned at the head of the table, and a small pillow is placed below the shoulders to enable neck extension. The surgeon usually sits at just behind the head of the table. A Boyle-Davis mouth gag which is self-retaining is inserted and widened to keep the mouth open during the procedure. The tonsil is grasped by Allis forceps with medial traction to induce tissue tension. Slight pressure by the finger from outside (below and behind the angle of the mandible) may be needed to facilitate medialization of the tonsil before gripping it. Tonsillectomy is then performed using one of the following methods.

Cold dissection tonsillectomy

This technique is started by identification of the peritonsillar space; it usually appears as a depression on the anterior tonsillar pillar (few millimeters above and lateral to the upper part of the tonsil which is medialized) (Fig. 1). The peritonsillar space is opened by the tip of the scissors (sharp pointed) which are then insinuated below the mucosa of the anterior faucial pillar around the tonsil. The mucosa is incised around the tonsil (about 2 mm from the tonsil). The peritonsillar space is entered and widened with a blunt dissector between the tonsillar capsule and the superior constrictor muscle. Then, we continue the blunt dissection downwards in the same plane with a cotton piece on an artery forceps until separation of the tonsil from its bed except its lower pole. Sometimes, the mucosa of the posterior pillar needs snipping with the scissors at its upper part. The lower pole is clamped and excised. Ligation of the lower pole is

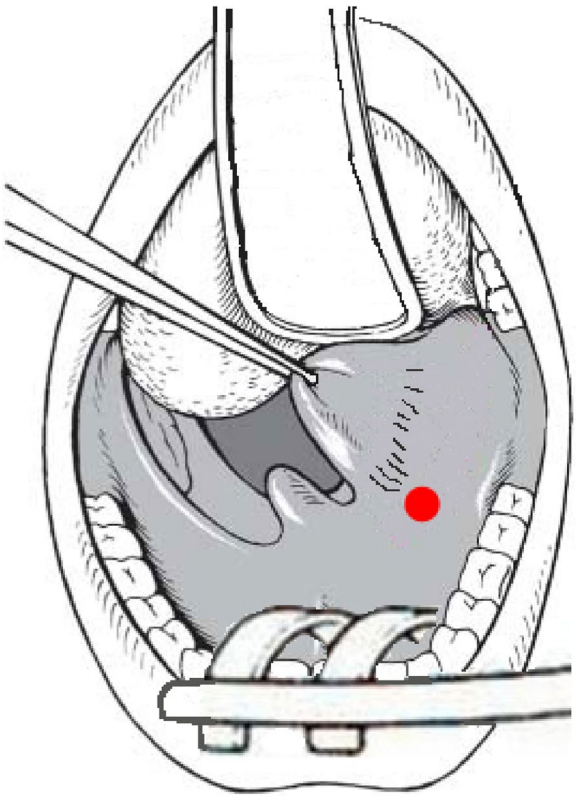

Fig. 1 The red dot indicates the site of the peritonsillar space (few millimeters above and lateral to the upper pole of the tonsil)

performed with Vicryl suture (00) before removal of the clamp. The tonsillar fossa is then packed temporary with a cotton swab until removal of the other tonsil. The same procedure is performed on the other side. After removal of both tonsils, the cotton swabs are removed, and hemostasis is carried out using either ligature or bipolar diathermy (cold dissection with electrocautery hemostasis).

Coblation tonsillectomy

It is also termed as cold ablation, controlled ablation, plasma mediated ablation, or bipolar radiofrequency ablation; in which radiofrequency energy is used in a plasma field to break the molecular bonds, it excises and dissolves the soft tissue at a temperature of 40–70 °C. It provides dissection, cautery, suction, and hemostasis in the same machine. The surgeon uses a plasma wand which has 4 components: an irrigation port which is attached to a saline drip, a suction port to remove molecular debris caused by tissue removal, an active electrode array, and a return electrode. This method uses a radiofrequency energy to excite electrolytes within saline medium to disrupt the soft tissues. Bipolar cauterization of larger vessels can be done by the same wand. The plasma wand needs a "near touch" technique to remove the tonsil tissue [5, 6, 8].

The device has a set of foot pedals. One pedal operates as bipolar cautery (the blue one), and the other is the active plasma field (the yellow one) (ArthroCare ENT, Austin, TX, USA). The process starts with setting the power level to 9 for bulky tissue removal, and then the power can be reduced to 7 or 5 until completion of the procedure. Bleeding may be encountered if the capsule is injured. Bipolar cautery is used when bleeding occurs [6, 8]. At the end of the procedure, both tonsillar fossae do not need to be packed with cotton swabs, and they appear to be covered with a yellowish-brown plasma layer.

Electrocautery tonsillectomy

Dissection and removal of the whole tonsil using either monopolar or bipolar diathermy. Heat of cautery may reach 300–400 °C to induce hemostasis. In bipolar electrocautery, the surgeon uses forceps that include active and return electrodes in a closed-circuit manner. With monopolar electrocautery, two electrodes are placed away from each other on the patient, and the current passes through the body between these two sites. The surgeon holds the active electrode and uses it for incision and dissection, whereas the return electrode is usually placed under the patient's thigh [3, 9].

The Bovie handpiece is used to dissect precisely in the fascial plane medial to tonsil capsule. Close dissection to the tonsil is crucially important to avoid muscular injury. The inferior pole of the tonsil is excised with the use of the Bovie handpiece. The Bovie unit is usually be set in the range of 10–15 W to accomplish the procedure in a low-wattage manner to avoid muscle charring. Proper dissection allows for vessel cauterization and hemostasis. Bleeding is usually unremarkable, so packing of the tonsillar fossae is usually not needed. At the end of the procedure, exposed vessels or bleeding points can be cauterized carefully at a setting of 30–35 W [6, 10, 11].

Laser tonsillectomy

Laser tonsillectomy is emerged as a new technique for tonsillectomy in 2006 when the National Institute for Health and Care Excellence (NICE) reported its application in UK practice [12]. A variety of laser types can be used including carbon dioxide (CO_2) laser, potassium titanyl phosphate, contact diode, and argon plasma coagulation (APC). However, CO_2 laser could offer advantages of cutting as well as ablation of tissue, so it is the most used laser modality in tonsil surgery [13]. Precautions should be taken for the safety of personnels during the use of laser beam. For CO_2 laser (AcuPulse system, Lumenis, Germany), the beam is used in continuous mode at 18 W with circular dot of size 2.0 mm [14]. The procedure starts by opening the peritonsillar space and then separation of tonsil from its bed; the beam is usually directed to the tonsil rather than the muscle during dissection. Packing of tonsillar fossae with cotton swabs is not needed.

Advantages and disadvantages

Tonsillotomy was not considered in this study. In our country, leaving tonsillar tissue remnants is annoying event for child's family who may sue a legal claim against the surgeon. Tonsillectomy may have many complications; however, due to it is a commonly practiced procedure, the complications may be parentally unacceptable. Debates among surgeons about the best surgical technique may be endless, and every surgeon has their own approach to how they do it. There is no universally accepted "gold standard technique" for tonsillectomy, as each technique has its own advantages and disadvantages. Even a particular technique can be done by different ways based on surgeon's experience and training.

Issues that give impact of a technique over another are the comfortability for both patients (primarily) and surgeons (secondarily) in the meaning of different points including operative time, intra- and postoperative bleeding, postoperative pain, wound healing and time to return to the usual life, long-term side effects, cost of the procedure, and finally family satisfaction after explaining advantages and disadvantages of each technique.

Operative time

Operative time for any technique is considered from insertion of mouth gag until its removal, including removal of the tonsils and achieving complete hemostasis [6]. The operative time differs widely in the literature: for cold dissection technique: ranged between 15 and 35 min [3, 11, 15–17], for coblation technique: ranged between 12 and 30 min [11, 17, 18], for electrocautery technique: ranged between 8 and 30 min [3, 11, 18], and for CO_2 laser technique: ranged between 15 and 38 min [3, 14].

Recently, Kandemir et al. [11] compared 3 tonsillectomy techniques: cold dissection, monopolar electrocautery, and coblation. Although they considered surgical duration is an important factor that affects the choice of operative technique, they reported that the level of surgeon's experience, and familiarity with a special technique and the equipment used, is oppositely correlated with surgical duration. However, they found that surgical duration was not significantly differ among various surgical techniques. Also, Verma et al. [3] reported that the real operative time was comparable across all surgical methods.

There has been a wide range in operative time between the literature; this could be attributed to the facts that the level of surgeon experience, and familiarity with a particular technique and the equipment used, is inversely correlated with surgical duration [6, 11]. Despite the debates about the operative time taken during the procedure and its relation to the tonsillectomy technique used, many authors found that this issue represents insignificant difference among various methods [3, 6, 11, 18, 19]. Our experience is matched with the results of many studies [4–7] in that hot techniques are generally faster than cold technique which may need additional time for hemostasis. However, factors that may have direct effects on operative duration is the learning curve of the surgeon, the patient's age with shorter time in younger ages, and conditions of the tonsil as the procedure may take a longer time in patients with prior peritonsillar abscess due to fibrosis and adhesions between tonsillar capsule and muscle.

Intraoperative blood loss

No doubts that hot techniques have the least intraoperative blood loss [4, 6, 7]; this is because hot procedures are based on cutting and hemostasis in the same time. However, coblation unit may have slight advantages over electrocautery tonsillectomy [7]. Intraoperative bleeding can be considered an important point for the choice of technique, particularly in young children with small blood volume and patients with bleeding diathesis [6]. Some surgeons use cold technique and perform hemostasis with electrocautery either monopolar or bipolar diathermy. Others may use ligation or suturing for bleeding points in cold tonsillectomy technique. Even surgeons may suture the tonsil pillars routinely in cold dissection technique to reduce the intraoperative bleeding and to facilitate wound healing [20].

The National Prospective Tonsillectomy Audit reported that the ability to reduce intraoperative blood loss is probably an important factor which increase the popularity of electrocautery especially in young children, despite many suggestions that the use of diathermy may increase the rate of secondary hemorrhage postoperatively. Also, the use of electrocautery for hemostasis in cold dissection tonsillectomy might be a reaction to excessive intraoperative bleeding [21]. The fact of less intraoperative bleeding with hot techniques has been reported in many studies [22–25]. A metanalysis done by Pinder et al. [26] showed more intraoperative blood loss in cold dissection technique than in hot technique; however, the difference was about 21 ml/patient which constitute about 2% of the blood volume of an average 2-year-old child. So, this factor is not strong enough to force a surgeon to change his favorable technique.

Postoperative pain

Postoperative pain is an important factor which negatively affects oral feeding and quality of life; it may be due to mucosal cutting, injury and exposure of glossopharyngeal nerve fibers, pharyngeal muscle spasm, thermal injury, and postoperative inflammation. Pain measurement is a difficult issue, as it depends on the subjective perception of the patient, which can be influenced by the level of pain thresholds that is variable between patients [11]. Most studies demonstrated that cold dissection technique is the least painful method when compared to other hot tonsillectomy procedures [4, 6, 9, 27, 28]. Kandemir et al. [11] found that the use of analgesics was significantly lesser after cold technique than after electrocautery technique, but the difference between cold dissection and coblation was not significant. Also, they reported that cold dissection tonsillectomy has the shortest duration time to return to the usual activity relative to electrocautery and coblation; however, the difference was significant between cold dissection and electrocautery and non-significant between cold dissection and coblation. Our explanation for these findings is that cold technique has no thermal collateral damage which is more in electrocautery and less in coblation. Rubinstein and Derkay [29] found that children who subjected to less cauterization recovered more quickly with less discomfort, whereas Lister et al. [30] reported that 80% of children may have otalgia after electrocautery tonsillectomy.

Some studies reported that coblation technique may be associated with less pain especially in the early

postoperative period; it results in less epithelial damage and no collateral tissue burning compared with electrocautery [9, 25]. In a prospective randomized controlled trial (RCT) done by Polites et al. [31] in which patients underwent cold dissection tonsillectomy on one side and coblation tonsillectomy on the other; postoperative pain level in coblation group was significantly lower for the first 3 days, following which the difference was not statistically significance. Also, Parker et al. [32] and Hafiz et al. [33] found significant less postoperative pain after coblation tonsillectomy as compared to cold dissection tonsillectomy for only the first 6 h; thereafter, there were no differences in pain scores between both techniques.

However, in another prospective, RCT done by Philpott et al. [34] showed no significant difference between cold dissection and coblation techniques in regards to postoperative pain, and the authors reported that patients who operated with cold dissection technique regained normal eating earlier. Conversely, Verma et al. [3] reported that cold dissection technique exposes the underlying muscular bed, and so, it can cause more pain postoperatively.

Bhankhodia et al. [28] reported that electrocautery has the highest post-tonsillectomy pain score followed by laser then cold dissection. Kumar et al. [14] found that laser tonsillectomy may have pain scores comparable with cold dissection in the initial postoperative days, but towards the end of first postoperative week, the pain usually increases in those exposed to laser. The National Institute for Health and Care Excellence (NICE) in 2006 reported that laser technique is associated with less pain in the first 24 h but with worse long-term pain over 2 weeks postoperatively [12].

Postoperative bleeding

Postoperative bleeding leads to increased hospital outlays due to emergency unit visits, readmissions, and sometimes the need to return to the operating theater. Post-tonsillectomy bleeding could also be very stressful to patients and their families. There are many risk factors for this problem including surgeons' level of training, surgical technique especially using hot procedures, male gender, and patients' age with increased risk in adults [20]. Most postoperative bleeding are usually secondary hemorrhage, which is more common between the 5th and 10th postoperative days [5]. Repeated attacks of minimal bleeding might be considered as an alarming sign of serious post-tonsillectomy hemorrhage [3].

The National Prospective Tonsillectomy Audit defined secondary hemorrhage as any bleeding that led to hospital readmission within the postoperative 4 weeks. The audit reported an incidence for this type of bleeding to be generally 2.9%, with increased risk when using hot techniques. Bipolar diathermy tonsillectomy has 3.1 times higher than cold dissection, this risk factor decreased to 2.2 when diathermy was used for hemostasis in cold dissection technique, whereas coblation tonsillectomy has 3·4 times higher than cold dissection. The audit concluded that hot techniques have a higher rate of hemorrhage compared with cold dissection technique [21]. Baugh et al. [35] reported that hot surgical techniques (either diathermy or coblation) increase the risk of post-tonsillectomy hemorrhage by three-fold when compared with cold dissection technique, whereas this risk decreases to 1.5-fold on using cold dissection for tonsil removal and bipolar diathermy for hemostasis. Also, they stated that the use of coblation could be associated with an elevated risk of return to the operating theatre for bleeding control. The cause of secondary hemorrhage is usually sloughing of the primary eschar situated in the tonsillar bed which heals by secondary intention, so it is logic to be more common with hot techniques. The heat produced by these techniques produces hemostasis during tonsil dissection and may increase the post-tonsillectomy bleeding [1]. The same concept is applied on laser tonsillectomy [36].

Wound healing and recovery time

The fact that healing is usually faster in cold surgical wound than hot burnt wound can be typically applied in tonsillectomy. Bhankhodia et al. [28] reported that conventional dissection technique has the least recovery time, least tissue reaction, and least hospital stay in comparison to electrocautery and laser technique. Magdy et al. [8] have previously compared our 4 studied techniques regarding tonsillar fossa healing; they found no significant difference between coblation and dissection techniques. However, the healing was slower in electrocautery and laser techniques than in coblation. Also, Rubinstein and Derkay [29] reported that children exposed to less cauterization usually recover more quickly than who underwent the operation with electrocautery, and excessive cauterization could lead to delayed return to normal diet and normal activity. Moreover, Kandemir et al. [11] found that the time to regain normal activity was shorter in children who underwent cold dissection tonsillectomy than those who subjected to electrocautery technique. Also, this time was shorter in coblation tonsillectomy than in electrocautery, whereas it was longer in coblation tonsillectomy than cold dissection tonsillectomy.

Other sequelae

An early postoperative nausea and vomiting are other common complications after tonsillectomy. It may occur in up to 70% of children who did not receive prophylactic anti-emetics especially in the first 24 h after surgery.

It could lead to increased rates of hospital readmission, increased necessity for intravenous fluid, increased intake of analgesics, and decreased patient and family satisfaction. The recommendation to decrease these sequelae is to give a single dose of dexamethasone (0.5 mg/kg) during the operation [3, 4]. In addition, a single dose of ondansetron may be prescribed routinely for outpatient surgeries [4]. However, the occurrence of postoperative nausea and vomiting is not related to a particular technique rather than the procedure itself [3, 4, 10].

As the hot techniques produce more tissue reaction and collateral damage, they cause more tissue fibrosis than cold techniques [8, 28]. The resultant fibrosis may induce either velopharyngeal insufficiency (VPI) or velopharyngeal stenosis (VPS) [37]. Magdy et al. [8] found that the depth of tissue damage was more after electrocautery, followed by laser, and to less extent after coblation. However, the damage is usually more after monopolar than after bipolar diathermy as the latter uses less energy [15, 16]. Abdel-Aziz [38] reported that using electrocautery may cause tethering of the soft palate that may lead to VPI. Conversely, velopharyngeal stenosis causing SDB has been rarely detected after electrocautery, laser, and coblation tonsillectomy [37].

Cost of the procedure

Although cost of the procedure is an important issue, it has been rarely mentioned in the literature. Meiklejohn et al. [39] compared 3 techniques regarding cost-effectiveness; they detected that coblation has the highest cost, followed by electrocautery, and then cold dissection which is less costly. Also, they found that cold technique has the least environmental impact related to disposable surgical equipment which increases the cost. However, using laser system in tonsillectomy could increase the cost of the operation more than any other technique.

When considering the cost of the procedure, we should address some points such as the disposable materials used in each technique, the duration of surgery, the hospital stays postoperatively, the duration and dose of medications (analgesics), and the need for readmission in cases of complications. All these points (except surgical duration time) indicate that cold dissection technique is less expensive than all other techniques.

Family perceptions

Preoperatively, parents are usually asking for technical innovations, and they prefer the new methods of tonsillectomy for their children. Laser tonsillectomy may take the largest space in Egyptian parental minds. Postoperatively, the intensity of pain and recovery time are the most concerned points for the family. However, occurrence of a complication could negatively affect familial satisfaction. The psychological and financial impacts of these postoperative events on families cannot be missed and need to be studied. Caring for a patient with a post-tonsillectomy hemorrhage is an unforgettable drama for the family. This life-threatening complication is not subtle and may need readmission and sometimes annoying interventions for the parents and patient [29]. So, family counseling about the advantages and disadvantages of each technique is highly important.

Conclusion

In Egypt, the most used tonsillectomy techniques are cold dissection, electrocautery (using either monopolar or bipolar diathermy), cold dissection with electrocautery hemostasis, coblation, and laser. Cold dissection is still considered the gold standard technique. Caution should be taken on using hot techniques especially when used for dissection, and the trainee surgeons should become familiar with cold dissection before shifting to other tonsillectomy techniques. Hot techniques have shorter operative time and less intraoperative blood loss, while cold dissection technique has less postoperative pain and less postoperative complications especially secondary hemorrhage, with more rapid wound healing. However, coblation technique may have less pain in the first few hours postoperatively relative to cold technique. Electrocautery technique is the most painful method with delayed wound healing. Laser technique is nearly equivalent to electrocautery with slightly less pain. Cold dissection technique is less costly when compared to other techniques. Family satisfaction after tonsillectomy is dependent mainly on less postoperative pain and rapid recovery. From this study, we can say that hot techniques should not be used except after mastering the cold dissection tonsillectomy; also, the new advanced techniques can be reserved for high-risk patients such as having bleeding disorders.

Abbreviations

SDB	Sleep-disordered breathing
UK	United Kingdom
NICE	National Institute for Health and Care Excellence
CO_2	Carbon dioxide
APC	Argon plasma coagulation
RCT	Randomized controlled trial
VPI	Velopharyngeal insufficiency
VPS	Velopharyngeal stenosis

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Authors' contributions

MA wrote the commonly used techniques and conclusion sections. AA wrote the abstract and cost of the procedure section. OAS wrote the introduction section. AIY collected and revised the references. ASA wrote the postoperative pain section. AAH wrote the operative time section. MA wrote the intraoperative blood loss and wound healing sections. AS wrote the postoperative

bleeding, other sequelae, and family perception sections. All authors read and approved the final manuscript.

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Availability of data and materials
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Declarations

Ethics approval and consent to participate
Ethics approval is not applicable. Consent to participate is not applicable.

Consent for publication
Not applicable.

Competing interests
Mosaad Abdel-Aziz is a corresponding author of this study and editorial board member of the journal, and Ahmed Atef is a co-author of this study and editor in chief for the journal. Both declare competing interest for this submission. Both have not handled this manuscript. The rest of the authors declare that they have no competing interests.

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