Intra and post-operative complications of esophageal achalasia

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Intra and post-operative complications of oesophageal achalasia

AIM: *To evaluate and discuss all the potential complications affecting morbidity of patients treated with surgery for primary achalasia.*
MATERIAL OF STUDY: A *review of the available English literature published to date has been conducted. All articles reporting surgical experience in achalasia were examined and then were selected only those specifically inherent to the topic at issue.*
RESULTS: *Mucosal perforation is the main intra-operative complication while persistence or recurrence of the disease and gastro-esophageal reflux are those mostly affecting patients afterwards, even at long-term follow-up. A few other less common morbidities, as well as the technical considerations useful to minimize and manage each complication mentioned, are reported.*
DISCUSSION: *Minimally invasive surgery for achalasia consent to treat patients with a low rate of perioperative complications that can be managed with conservative approach in the majority of cases. Risk of esophageal cancer exists in these patients and remains although surgical therapy.*
CONCLUSIONS: *Laparoscopic Heller myotomy along with partial fundoplication is a safe and effective procedure that should be considered as the treatment of choice at first evaluation of achalasic patients rather than endoscopic techniques. Robotic technology may add further contribution in diminishing perioperative complications.*

KEY WORDS: Achalasia, Complication, Heller esophagomyotomy

Introduction

Surgical treatment for achalasia, performed since many years in a minimally invasive fashion worldwide, has shown in several studies its superiority compared to endoscopy in terms of long-term outcome results and morbidity rate (ranging 0-13% in the main series), assessing laparoscopic Heller esophagocardiomyotomy as the first choice treatment at disease presentation for every patient suitable for a surgical intervention [1,2]. Recently, the employment of robotics in general surgery seems to further improve some technical aspects of the operation making it easier and safer to perform, contributing to the decrease of perioperative morbidity [3].
Literature experience reports mucosal perforation as the most common intra-operative complication occurring in patients treated laparoscopically or with open approach [4], but tending to zero when a robotic procedure is performed. Among post-operative complications, failure of myotomy presenting with recurrent or persistent dis-

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phagia on the one hand and gastro-esophageal reflux on the other hand are those mainly cited and the ones that still promote much debate in the surgical community due to technical issues deemed to be responsible for their onset.

We herein discuss in detail the above mentioned morbidities and other complications, less common, that patients undergoing surgical treatment for achalasia can experience during and after the intervention.

Intraoperative complications

Perforation

Mucosal perforation is the most important adverse event that can occur during surgical intervention for achalasia. Its overall incidence ranges from 5% up to 33% of Heller myotomies according to published literature [5], with difference between open (1-7%) and laparoscopic approach (3-25%) usually interpreted as the result of poor manual perception of esophageal muscular wall thickness when performing minimally invasive procedures [6]. Anyway, largest recent series of laparoscopic myotomies report lower perforation rates (3-7%); in addition, over this 20 years period since the first laparoscopic Heller intervention the role of minimally invasive approach in achalasia surgery has been radically accepted to an extent that classical open myotomies are hardly performed nowadays.

Even though mucosal tears may occur also during mobilization and hiatal dissection of the mediastinal esophagus, the typical situation is an injury at the time of myotomy over the gastro-esophageal junction; this is due to the relative thinness and fragility of the mucosa at that level, especially on the gastric side of myotomy, and to the possibility of a burning lesion with the electrocauthery while dissecting muscular fibers or in the attempt to stop bleeding from myotomy's edges [5].

Since the introduction of alternative endoscopic therapies, pneumatic dilation and botulin injection, many authors have blamed these techniques as factors able to increase intraoperative perforation rate if performed previously than myotomy because of the fibrosis development in the gastro-esophageal wall. These authors describe technical difficulty in dissecting submucosal planes which are often obliterated in those patients as well as troublesome can be esophageal mobilization due to mediastinal scarring resulting from those prior therapies [7,8]. On the contrary, some other studies have not recognized this negative role showing no influence of previous endoscopic treatment on perioperative outcome, thus stating that inadvertent mucosal injury cannot be predicted on this base [9,10]. A recent meta-analysis of 105 articles reporting on more than 7.800 patients treated with endoscopy and/or surgery, in view of the supposed histological changes induced by endoscopic therapies and the consequent increased risk of perforation, suggest that pneumatic dilation and botulin injection should only be considered alternative treatments in patients not good candidates for surgery or after surgical failure.[1] Although there is no strong evidence that the impact of therapeutic endoscopy can affect final surgical outcome of myotomy, it appears quite evident that an increased technical difficulty in performing Heller procedure exists after endoscopic treatments.[7] A similar anatomic situation can be expected when attempting re-do cardioesophageal myotomies after failure of the first intervention [11].

In the majority of cases mucosal perforations are recognized intraoperatively giving the surgeon the chance to repair them suddenly with absorbable interrupted sutures; this usually consent to close the defects avoiding any clinical consequence on surgical outcome. A prompt identification of mucosal lesions is the key for uneventful postoperative course; unrecognized injuries can lead to dangerous peritonitis or mediastinitis with sepsis and potential need for reintervention.

For this reason, many surgeons have adopted routine intraoperative leak tests to identify any potential missed lesion such as injection of methilene blue down the nasogastric tube or simply inflating air in the esophagus dipped in a water-saline solution. These are low-cost, safe and not time-consuming tricks also useful to assess a correct, watertight repair of discovered leaks.

Differently, routine adoption of upper gastrointestinal contrast study after surgery has been demonstrated unnecessary, expensive and unuseful because of the high rate of false negative errors and poor sensitivity when applied to unselected patients treated for achalasia. Therefore its use should be tailored on specific cases deemed at high risk of perforation on the base of intraoperative events and postoperative clinical conditions. This screening method ensures a safe, appropriate and cost-effective resource utilization to confirm diagnosis of suspected leak [12].

Even if controversy is still present about the type of fundoplication that should be adopted after Heller myotomy, it is common opinion that an anterior Dor technique can add further protection acting as a cover that buttresses the mucosa plane, thus preventing any peritoneal spillage from the esophago-gastric lumen and promoting healing of hole repair. This issues should be considered while choosing the appropriate anti-reflux procedure to match with Heller myotomy [11,13].

Different results come from the application of robot-assisted surgery. Some comparative studies between laparoscopic and robotic approach with Heller esohagomyotomy published since 2005 have reported a surprisingly 0% of intraoperative perforation when robot is adopted [3,14,15]. The peculiar features of robotic systems (high dexterity movements of the instruments, tremor abolition, motion scaling, stable and tridimensional vision, ergonomics) consent a superior sharpness and precision in identifying and dissecting the muscular fibers

at the esophago-gastric junction compared to traditional laparoscopy. Anyway, the level of evidence available at the moment for this presumed superiority is low since no randomized trial have been conducted to date.

Pleural Effusions and Pneumothorax

These are quite common but usually uneventful complications of esophageal surgery, not specific of achalasia treatment and are the consequence of hiatal dissection manoeuvres and freeing of the distal third of the esophagus that can irritate or lead to injuries of the mediastinal pleura; in this last case pneumoperitoneum inflates pleural cavity and forces the lung to collapse. Among intra-operative complications they are the most frequently reported in many series after mucosal perforation. Some authors suggest that a pleural drainage tube should be routinely positioned at the end of the intervention as a part of it when a large hiatal hernia or a concomitant esophageal diverticulum are treated [16].

Visceral Injuries

Accidental iatrogenic enterotomies can occur in patients with peritoneal adhesions for previous upper abdominal or hiatal surgery. Usually visceral injuries are recognized intra-operatively and sudden repaired with suturing so that they don't modify the post-operative course of these patients. On the contrary, rare missed lesions can lead to peritonitis or mediastinitis that may need prolonged hospital stay, reintervention, ICU or even cause death.

Need for Conversion

Conversion to open surgery is rarely reported in literature series of laparoscopic Heller myotomy. The reasons for conversion encountered in surgical experience are inability to repair a visceral perforation, bleeding from organ (liver, spleen) lesions or peritoneal adhesions that impede to carry on the intervention.

Post-operative complications

Recurrent or Persistent Disphagia

Although many series published in the last decade indicate good or excellent functional results after Heller myotomy even at long-term follow-up, a significant percentage of patients continue to experience symptoms similar to those complained before surgery revealing failure of the intervention. In literature this subpopulation of patients amounts approximately at 10% average with a range going from 5% to 30% [17], but the exact proportion of people who really suffers from this disturb, to the extent that a therapeutic option is required, is quite hard to assess considering that in the majority of the studies disphagia is often reported on specific scales or scores based on level of perception rather than frequency of presentation.

From an ethiopathological point of view, great importance is ascribed to the extension of myotomy which can result to be inadequate providing incomplete emptying of the esophagus since early post-operative time. Anyway, patients often refer a significant improvement of their disphagia even if myotomy has not been complete probably because most of them were severely symptomatic before surgery [4]. At the base of an inadequate dissection of muscular fibers at the gastro-esophageal junction two issues may be implicated at least. First of all, surgical achalasia treatment technically relies on a delicate balance between relieving the functional obstruction to the emptying of esophagus at its lower sphyncter and avoiding or minimizing the risk of a post-operative gastro-esophageal reflux syndrome. Second, there is a tendency in not carrying myotomy enough on the gastric wall because dissection at this level becomes more difficult than onto the esophagus, being less distinct the plane between the muscular fibers and the mucosa, thus increasing risk of gastric perforation [4]; in addition, the more the myotomy is carried downward on the stomach, the bigger becomes the risk of causing reflux [13]. Traditionally the length of the myotomy at the gastric level measures about 1-1,5 cm [4,] but several series have reported significantly better results in terms of post-operative recurrence of disphagia with extended myotomies of 3 cm or more [18,19]. The current spreading opinion sees a minimum of 2 cm extension as a good compromise to obtain adequate achalasia treatment along with contained risk of mucosal perforation and postoperative reflux [20].

Some authors retain that the correct extension of any esophageal myotomy should not be assessed on a mere approximate measure but that objective evaluation is required. Intra-operative manometry, although not available at every centre, has been reported as a useful tool to identify any high pressure residual zone at the esophago-gastric junction allowing to adjust muscular dissection suddenly at the time of intervention [21]. Similarly, and maybe easier to arrange, intra-operative endoscopy can give an indirect but reliable evaluation on the adequacy of myotomy based on how smoothly the endoscopic tube can pass through the lower esophageal sphincter after muscular dissection has been performed at that level. According to literature experience the main contribution of intraoperative endoscopy is the correct identification of the gastro-esophageal junction especially during minimally invasive procedures where tactile sensation lacks and the only anatomical landmark is the changing direction of the muscular fibers; furthermore, endoscopic transillumination with mild pneumatic distension of the cardiac allows to visualize any residual circular muscle fibers yet to be dissected at that level [22].

Other causes deemed responsible for failure of surgical treatment with persistent or recurrent achalasia have been reported though not yet completely defined. Stricture or scar formation at the site of myotomy, usually on its gastric side, can slowly lead to impairment in esophageal emptying: a myotomy that appears adequate for length but fails to widely separate dissected fibers is exposed to that risk as well as a short one. Some surgeons usually choose a Toupet fundoplication as anti-reflux technique sewing the edges of myotomy at the gastric band in order to keep them sufficiently distant and avoid their fibrotic healing. An excessively tight fundoplication performed in the effort of minimizing postoperative reflux symptoms is another well-known mechanism for failed interventions [4]. Long-term follow-up has demonstrated in several series that a total Nissen fundoplication is not appropriate in patients treated for achalasia where an aperistaltic esophagus cannot exert any propulsive motility against a 360° gastric wrap around distal esophagus [23]; a significantly higher recurrence rate of disphagia has been complained by those patients compared to others treated with partial fundoplication also in a recent randomized controlled trial on 144 patients [24]. Anyway, even though level 1 evidence exists about that, some surgical groups still report good outcomes performing a floppy Nissen technique after myotomy [25,26]. At last, development of carcinoma of distal esophagus, a late potential risk in achalasia patients even after surgical treatment, can determine recurrence of symptoms in the fashion of a pseudoachalasia which requires early identification and appropriate therapy.

Treatment strategy for patients developing or continuing to complain disphagia after surgery include re-do operations or endoscopic dilation with or without botulin injection. A few reports have been published to date about this. According to a 2007 survey, patients with recurrent disphagia can be distinguished in two different groups, one with early recurrence related to inadequate myotomy for length or scarring and another one with late recurrence in a set of irreversible progression of the disease with development of megaesophagus; the authors report that while the first group can benefit from remyotomy both with open or laparoscopic approach more than from endoscopic procedures, the second one has no other choice except a demolitive intervention like esophagectomy [27]. A recent review of literature experience concludes that re-do Heller procedure has the best clinical efficacy in cases of failure of first myotomy and that the indication to reoperate these again symptomatic patients should be balanced mainly on their personal acceptance of a second intervention and on general limitations to surgery such as age and co-morbidity [28].

Post-Operative Leak

Although the majority of perforations are promptly recognized and repaired intra-operatively several series report spare cases of leaks which become evident during the early course after surgery. Since the consequences of an inadvertent mucosal injury during the intervention can be extremely dangerous and potentially life-threatening, careful observation is mandatory on a patient who develop chest pain, fever and other signs of sepsis on post-operative period. Diagnostic work-up for confirmation of any suspected leak includes contrast water-soluble radiogram and CT scan to assess signs of related complications (abscess, fluid collections, mediastinal bubbles); endoscopic evaluation, even though more sensitive for leak detection than contrast esophagogram, increases the risk of worsening a small leak susceptible of spontaneous healing [4]. Promoters of intra-operative leak testing or post-operative routine contrast radiographic studies enhance the usefulness of these techniques in order to prevent this unfrequent but possible complication.

Most of these cases anyway fully recover with conservative treatment based on prolonged parenteral nutrition, antibiotics and percutaneous drainages when needed but larger leaks or patients unresponsive to medical therapy may require reoperation.

Gastro-Esophageal Reflux

Post-operative gastro-esophageal reflux is considered as one of the main reasons for long-term failure of Heller myotomy, due both to the impairment in patient's quality of life and to the potential relapse of achalasia induced by chronic peptic complications [29]. Surgical disruption of lower esophageal sphincter allows to relieve functional obstruction creating a low pressure zone at the cardia which is however unable to prevent gastric acid exposure of the esophageal mucosa; the inability of an adequate clearing provided by the typical aperistaltic esophagus adds up to this. Ph-metric studies after surgical treatment for achalasia reveal that this phenomenon is more frequent than it appears clinically [30]. Thus, the majority of surgeons usually add to Heller myotomy an antireflux procedure in the shape of a fundoplication. In this context of general agreement, residual controversy still exists anyway about whether or not a fundoplication should be performed; there are some authors who are against it because of the increased risk of disphagia and the absence of significant difference about the development of symptomatic reflux in their series between patients undergoing or not to a fundoplication [29,31]. However, a recent systematic review and meta-analysis including more than 4.800 patients treated with surgery has shown that the incidence of post-operative reflux (measured either clinically or with ph-metric study) is significantly lower if an antireflux procedure is added to Heller myotomy; symptoms are reduced from 31% to 9% while reflux at ph-monitoring decreases from 42% to 15% without increased morbidity, specifically disphagia [1]. According to these data the addition of a fundoplication seems crucial for a satisfactory outcome.

Highly debated is also the type of antireflux technique that should be added to myotomy. A total floppy Nissen fundoplication reported by some as effective and not increasing the risk of disphagia seems however to be inappropriate in achalasic patients where it could determine a too much high resistance at the gastro-esophageal junction impeding the aperistaltic esophagus to correctly empty only by gravity [23]. A 2008 randomized controlled trial on 144 patients have confirmed this theory as well as another previous randomized double-blind trial had done [24,32]. That's why the majority of surgeons have switched to partial fundoplications. No level 1 evidence exists at the moment about the superiority of anterior rather than posterior approach even though SAGES is currently conducting a prospective multicenter randomized trial that may clarify this controversy in the next future [23]. Both techniques provide advantages of similar weight so that the surgeon, apart from selected cases where one procedure seems more appropriate than the other, should go on performing the one that he feels more confident with. Anterior Dor fundoplication is relatively simple since it does neither require posterior dissection nor short gastric vessels division and consent to cover the mucosal surface after myotomy giving protection against possible missed leaks; posterior Toupet technique ensures to keep well separated the edges of myotomy that can be easily sewed to the gastric band for this aim and may offer better results in terms of antireflux efficacy, anchoring the esophagus in the abdomen and preventing hiatal hernia recurrence [4].
However, medical treatment is usually enough to control reflux symptoms in the majority of patients affected whereas re-do surgery is substantially limited to those who develop peptic complications determining recurrence of disphagia [29].

Abdominal or Thoracic Infections

Subphrenic or mediastinal abscesses are rare complications usually due to a gastro-esophageal leak unrecognized at the time of the intervention or to an inadvertent injury in some other part of the intestinal tract in previously operated patients. Medical therapy and percutaneus drainages must be undertaken as first attempt but surgical exploration could be essential in severe cases. They are the main cause of mortality related to surgery in these patients [11].
Pneumonia is relatively common but not directly related to achalasia surgery, it usually prolongs post-operative course without increasing mortality.

Esophageal Cancer

Although it has been said that patients operated for achalasia have the same life expectancy of general population, it is known that the risk of developing an esophageal cancer many years after surgery is present to a higher degree than not achalasic people. Several case reports and cohort series have reported this issue so that it has been accepted the concept of achalasia as a precancerous condition. The ethiology explaining this relationship relies on two possible mechanisms: chronic retention of food that causes esophagitis due to bacterial overgrowth and production of nitrosamine leading to progressive dysplasia and squamous cells carcinoma; postoperative gastro-esophageal reflux could be the starting point for the development of Barrett's esophagus and subsequent adenocarcinoma [33]. At least two recent large cohort studies from Italy and Sweden have identically resolved, both identifying a statistically higher standardized incidence ratio of esophageal carcinoma in men with achalasia than in achalasic women or general population at long-term follow-up [33,34]. Though the reason of different incidence between sex is unclear, endoscopic follow-up of patients undergone to surgical Heller myotomy is advisable especially for male ones.

Riassunto

Il trattamento chirurgico laparoscopico di esofagomiotomia sec. Heller generalmente associato ad una plastica anti-reflusso parziale (Dor o Toupet) è descritto in letteratura come sicuro, efficace, riproponibile, con bassi tassi di conversione e complicanze intraoperatorie. La più conosciuta e temuta di queste è senz'altro la perforazione, esofagea o gastrica, in corrispondenza del tratto di cardias sottoposto alla miotomia. Precedenti interventi o trattamenti endoscopici per acalasia sono tra i fattori di rischio identificati in grado di influenzarne l'insorgenza che tuttavia non modifica in modo sostanziale l'outcome dei pazienti essendo la perforazione per lo più riconosciuta e riparata in corso di intervento. Il ricorso allo studio contrastografico post-operatorio, ritenuto superfluo come applicazione routinaria, può essere utile in casi selezionati sulla base dei suddetti fattori di rischio per identificare possibili lacerazioni misconosciute; analogamente, l'impiego dell'endoscopia o del blu di metilene possono incrementare la sensibilità nell'identificare lesioni mucose altrimenti inosservate. L'esecuzione di una fundoplicatio anteriore come la Dor fornirebbe infine un aiuto ulteriore a contenere i rischi di una perforazione nel post-intervento grazie all'effetto protettivo del fondo gastrico disposto a coprire la mucosa esofagea lasciata scoperta dalla miotomia. Secondo recenti esperienze pubblicate la tecnologia robotica, per le caratteristiche sue proprie di maggiore precisione e destrezza del gesto chirurgico, sembra in grado di azzerare l'incidenza di questa complicanza anche se mancano dati a favore di un'evidenza scientifica in questo senso.
A condizionare invece il decorso post-operatorio dei pazienti, specie nel lungo periodo, concorrono essenzialmente due fenomeni: la persistenza o ricorrenza della

malattia ed il reflusso gastroesofageo. Nel primo caso, che interessa circa un 10% degli operati, sembra determinante l'estensione della miotomia praticata all'atto dell'intervento che, se non sufficientemente condotta sul versante gastrico, può rendere inefficace la procedura non consentendo un adeguato svuotamento dell'esofago. Del resto, il prolungamento della dissezione sulla parete gastrica anteriore comporta un aumentato rischio di perforazione e predispone maggiormente allo sviluppo di sintomatologia da reflusso. L'utilizzo della manometria o dell'endoscopia intraoperatoria facilita l'identificazione della giunzione esofago-gastrica e della persistenza di zone residue ad alta pressione su cui intervenire. Anche una fundoplicatio eccessivamente stretta, come la Nissen, o lo sviluppo di tessuto cicatriziale tra le fibre muscolari sezionate possono essere chiamate in causa quali determinanti la disfagia post-operatoria che in certi casi diviene tale da richiedere un reintervento.

Il reflusso gastro-esofageo post-operatorio è conseguenza stessa della miotomia, che altera irreversibilmente il tono sfinteriale, e dell'assenza di peristalsi esofagea non in grado di offrire una clearance adeguata delle secrezioni acide gastriche. Ciò giustifica l'aggiunta alla procedura di una fundoplicatio solitamente parziale, Dor o Toupet, sufficiente in genere a prevenire i sintomi e le conseguenze correlate al reflusso cronico; all'opposto, l'impiego di una plastica a 360° o la mancata esecuzione di una fundoplicatio, sebbene variamente sostenute da alcuni gruppi chirurgici, non trovano in realtà particolare diffusione a fronte di un'evidenza scientifica ad essi pressoché contraria.

Infine, il rischio di sviluppare un carcinoma esofageo risulta significativamente maggiore in questi pazienti rispetto alla popolazione generale, in particolare fra i maschi, come possibile conseguenza del ristagno cronico di cibo e del reflusso. Raccomandabile quindi il follow-up endoscopico degli operati nel tempo.

Nella maggioranza dei casi le complicanze appena elencate traggono beneficio da un approccio terapeutico conservativo, mentre infrequente risulta il ricorso a reinterventi sia in urgenza che in elezione.

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