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Cross-sectional Study

Evaluation of oesophageal and gastric resection outcomes in a small-volume unit

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ABSTRACT

Introduction: Oesophagogastric resections continue to be a major surgical challenge with high morbidity, this has led to a worldwide trend for centralisation of these complex surgeries. However, there is no clear agreement on what constitutes a high-volume centre, leading to worldwide disparity. We evaluate our experience of oesophagogastric resection in a small volume unit to seek other factors that influence patient outcome.

Methods: We analysed 173 consecutive oesophagogastric resection from 2010 to 2020. The primary outcome was 30-day mortality and secondary outcome included peri-operative morbidity, length of stay, lymph node harvest, R0 resection. Collected continuous data were compared using the Mann-Whitney test and categorical data using the chi-squared test and expressed as p value.

Results: Of the 173 patients, 94 (54%) underwent hybrid minimal invasive esophagectomy (HIMO) and 79 (46%) underwent gastrectomy. 135 (78%) patients received Neoadjuvant therapy. The site of tumour was GOJ in 29%, distal stomach in 26% and distal oesophagus in 20%. Perioperative morbidity was observed in 18 (19%) after esophagectomy and 9 (11.4%) after gastrectomy. The median lymph node harvest was 18 (range 5–42) and 168 patients (97%) had longitudinal R0 resection. The most common complication was neurological seen in 3.6% followed by pulmonary complication and anastomotic leak seen in 5 patients (3%) each. The median in hospital stay was 6 days and the 30 day mortality was 2.9% with one year survival of 87%.

Conclusion: Small volume centres can produce comparable results. The outcomes depend on multifold parameters which include surgeon's experience in the field, ability to adhere to protocols and procedures and strong interpersonal relationship with individual patients.

1. Introduction

Oesophagogastric resections remain to be one of the cornerstones of treatment for oesophageal and gastric cancers [1]. Despite marked improvement of the surgical care, it is still widely recognised that this surgery is associated with considerable morbidity and mortality [2].

Over the last two decades, there have been a significant improvement in the management of oesophageal and gastric cancer, and this included advances in imaging, perioperative chemotherapy and radiotherapy, surgical instrumentation and techniques, perioperative nutritional support, and anaesthetic techniques. Undoubtedly, all of these have contributed to the overall improvement of outcomes after surgery [3]. Although postoperative mortality has progressively reduced to low levels ranging 0–5%, perioperative morbidity remains to be high at a level of 40–70% [4].

A lot of emphasis has been put in the literature on the advantages of centralisation of oesophagogastric resections to high volume units [5], but there is still no universal definition of what constitutes a high-volume unit. In work-load terms, this varied in the literature from 5 to 20 resections per surgeon per annum [6–8]. There are also conflicting data about the importance of the surgeon's annual volume versus the unit volume [6,7,9].

Majority of studies examine the outcomes after oesophagogastric resections in high-volume units focusing on the positive effects of centralisation [7,9]. Outcomes used for the assessment of the quality of oesophageal and gastric resections included 30 and 90-day mortality, perioperative morbidity, lymph node harvest, hospital length of stay, circumferential and longitudinal resection margins and one-year survival.

In this study, we aim to evaluate the outcomes after oesophageal and gastric resections in a small-volume unit from a single-handed surgeon to identify if there are other factors than unit volume which could

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influence outcomes.

2. Methods

Princess of Wales Hospital (POW) is part of the South West Wales regional MDT. Until October 2018, esophago-gastric resections were performed on two sites, POW being one of them. It is a moderate sized district hospital serving a population around 250,000 and the hospital is equipped with 7-bed intensive care unit and has on-site facilities for interventional radiology.

All patients with esophago-gastric cancer were seen by a single upper G.I. surgeon, supported by an upper G.I. cancer nurse specialist(CNS). Patients have their diagnosis, initial staging by CT scan and clinical assessment on-site then discussed in the weekly regional MDT meeting. Operable oesophageal cancer patients are staged further by CT-PET scan and endoscopic ultrasound scanning (EUS). Gastric cancer patients had staging laparoscopy at the beginning of their planned surgery. All patients had preoperative anaesthetic assessment and CPEX testing.

Till October 2018, esophago-gastric resections were performed by one surgeon in POW and since that time, the service was centralised to Swansea where the POW surgeon operates on his patients and work jointly with the Swansea team.

We standardised the main aspects of esophago-gastric surgical resections in 2010 and therefore we analysed data for 173 consecutive patients who had either esophagectomy or gastrectomy for cancer between August 2010 and July 2020. We excluded patients who had total gastrectomy and esophagectomy with colon interposition and those who had esophagectomy or gastrectomy plus other organ resection for a second cancer. Data was collected from a prospectively maintained database and was verified with the retained information by the regional MDT. Also, the clinical records and histopathology reports were reviewed to confirm the accuracy of data.

Outcomes after resection considered to be the 30 and 90-day mortality, perioperative morbidity, hospital length of stay, lymph node harvest, resection margins, and one-year survival after surgery. Although the cohort include gastrectomy as well as esophagectomy patients, we used the ECCG guidelines for reporting complications and the Clavien-Dindo classification for evaluating perioperative morbidity.

The hospital length of stay was calculated by subtracting the day of surgery from the day of discharge. And for evaluation of the circumferential resection margin, we considered it positive when cancer cells were present less than 1 mm from the resected margin.

The standard protocol used for this group of patients were:

2.1. Neoadjuvant treatment

Vast majority of oesophageal cancer patients received preoperative chemotherapy in accordance with OE02, OE05 or FLOT protocol. Patients with T1/T2 N0 proceeded straight to esophagectomy and only three patients had preop chemoradiotherapy.

Gastric cancer patients received perioperative chemotherapy according to MAGIC protocol unless presented as an emergency or unfit for two modality treatment when they proceeded straight to surgery.

2.2. Preoperative management

All patients were seen in the anaesthetic preassessment clinic and had various tests including cardio-pulmonary assessment. Patients who had inadequate calorie intake due to oesophageal narrowing or significant gastric disease were optimised prior to surgery by inserting oesophageal stent or laparoscopic feeding jejunostomy. Prior to surgery, patients had detailed discussion about the proposed procedure, and emphasis was put on expected postoperative pain and the importance of patients' contribution to early mobilisation.

2.3. Surgery

Oesophageal and junctional cancer patients had hybrid minimally invasive esophagectomy (HMIO) with two-field lymphadenectomy where they had laparoscopic mobilisation of stomach, lymphadenectomy and formation of gastric tube followed by right thoracotomy and stapled esophago-gastric anastomosis end to side. One posterior mediastinal chest drain is inserted, and two intercostal block catheters are inserted subcostally under vision above and below the transected rib. The chest drain is connected to one-way valve (Heimlich valve) and this is connected to a bile bag. Bolus of bupivacaine 0.5% (10 ml) is injected in each intercostal catheter at the end of surgery.

All patients with operable stomach cancer had diagnostic laparoscopy followed by laparoscopic gastrectomy either subtotal or total except two patients who had open subtotal in one and open total in the other. Standard lymphadenectomy was D1 + and gut continuity was achieved via Roux en-Y esophago-jejunostomy or gastro-jejunostomy. One drain is inserted in the abdominal cavity.

2.4. Postoperative care

Esophagectomy and total gastrectomy patients were routinely admitted to high dependency unit (HDU), and subtotal gastrectomy patients were selectively admitted to surgical ward.

Analgesia was achieved by the administration of regular I.V. Paracetamol ± NSAID for all patients and bupivacaine infused at a rate of 5–15 ml (0.125%) per hour for each catheter for esophagectomy patients only. Opioids were not used routinely and were reserved for the minority of patients who required further analgesia. Intercostal block catheters usually removed on day 3 and substituted with Diclofenac suppositories as required. Pain score was assessed for the first three postoperative days using numeric rating scale (NRS) with numbers from 0 to 10 ('no pain' to 'worst pain imaginable').

All patients were mobilised around the bed from day 1 and this was gradually progressed, where most patients walked up and down stairs on day 3/4 post-surgery. Nasogastric tubes were usually removed on the second postoperative day and oral sips of water was consumed on day 1 with the nasogastric tube in place and was gradually increased to free fluids on day 3. On day 4, most patients were consuming liquid diet including high-calorie drinks and chest drains are removed. All esophagectomy, and some gastrectomy patients were given Lansoprazole 30 mg Fastab from day 2 after surgery. Metoclopramide 10 mg liquid was also given tds to all patients from day 2 and continued for seven days.

2.5. Follow up

Patients were discharged home being able to walk up and down stairs and tolerating liquid diet including high-calorie dinks. They were discharged home with a direct telephone number for the upper G.I. CNS and was advised to contact the main surgeon via the hospital switch board should they have any concerns out of hours. The upper G.I. CNS telephoned all patients twice weekly in the first postoperative week then once weekly in the second week when patients were advised to commence sloppy diet. Patients were then followed up in the surgical outpatient clinic on the third week then every three months for the first year followed by six-monthly appointments thereafter.

2.6. Statistical analysis

Analysis of the dataset identified a non-normal distribution, and therefore data were expressed as medians with inter-quartile ranges (IQR) and non-parametric statistical methods were applied. Continuous data were compared using the Mann-Whitney test and categorical data using the chi-squared test and Fisher's exact test when the number of events were low. Differences were deemed to be statistically significant when the p value was less than 0.05. All data were inserted into Excel®

(Microsoft, Redmond, WA, US) and analysed with SPSS® version 20.0 (IBM, New York, US).

The study was compliant as per the STROCSS criteria [10] and is registered with Research Registry vide registration ID - researchregistry6643 which is accessible using this link - https://www.researchregistry.com/browse-the-registry#home/registrationdetails/60492252c931fc001c73750e/

3. Results

During the study we identified 182 patients who were deemed operable by the regional MDT and only 173 of them had resection. Nine patients (4.9%) with advanced disease on diagnostic laparoscopy were excluded from the study. Ninety-four patients had hybrid minimally invasive esophagectomy (HMIO) for oesophageal lesions, and 79 patients had gastrectomy (77 laparoscopic and 2 open) and of these, 34 total and 45 subtotal gastrectomies for gastric carcinoma. Fig. 1 shows the study flow chart.

The age ranged from 34 to 90years with a median of 68years. There was no statistically significant difference in the age and gender distribution among oesophageal and gastric cancer patients ($p = 0.880$, 0.639 respectively).Adenocarcinoma was the most common histological type. Neoadjuvant chemotherapy was given to 84 (89.4%), chemo-radiotherapy to only 3 patients (3.2%), and 7 patients proceeded straight to esophagectomy (7.4%). 51 patients received neoadjuvant chemotherapy before gastrectomy (65%). Table 1 depicts demographic and clinic-pathological details.

Four patients have had self-expanding metal oesophageal stent inserted prior to surgery and these were removed within the resected specimen. A needle catheter technique was employed for laparoscopic insertion of the feeding jejunostomy tubes JT (Freka®, 75 cm, 9Fr; Fresenius Kabi) in three patients prior to surgery and were removed three weeks after surgery [11]. Feeding jejunostomy tubes were laparoscopically inserted in a further four patients at different times after surgery. Two patients had the tube inserted when anastomotic leak was diagnosed, another patient had the tube inserted 18 months after surgery to supplement his feeding, and the last patient had it 4 years after surgery as part of the treatment of herniated small bowel to the chest.

Table 1
Demographic and clinic-pathological details of included patients.

Table 1: Patients' demographics and clinic-pathological characteristics		
Age:	<65 years	77 (44.5%)
	>65 years	96 (55.5%)
Sex:	Male	115 (66.5%)
	Female	58 (33.5%)
Type of cancer:	Adenocarcinoma	164 (94.8%)
	Squamous carcinoma	5 (2.9%)
	Other	4 (2.3%)
Site of tumour:	Gastroesophageal junction	51 (29%)
	Lower oesophagus	35 (20%)
	Mid-oesophagus	8 (5%)
	Distal stomach	45 (26%)
	Proximal stomach	34 (20%)
ASA grade:	1	42 (24%)
	2	55 (32%)
	3	63 (36%)
	4	13 (8%)
Neoadjuvant therapy:	Chemotherapy	135 (78%)
	Chemoradiotherapy	3 (1.7%)

Perioperative morbidity occurred in 18 esophagectomy patients (19%) and in 9 gastrectomy patients (11.4%) and this difference was statistically significant ($p = 0.039$).

Pulmonary complications post-esophagectomy occurred in 5

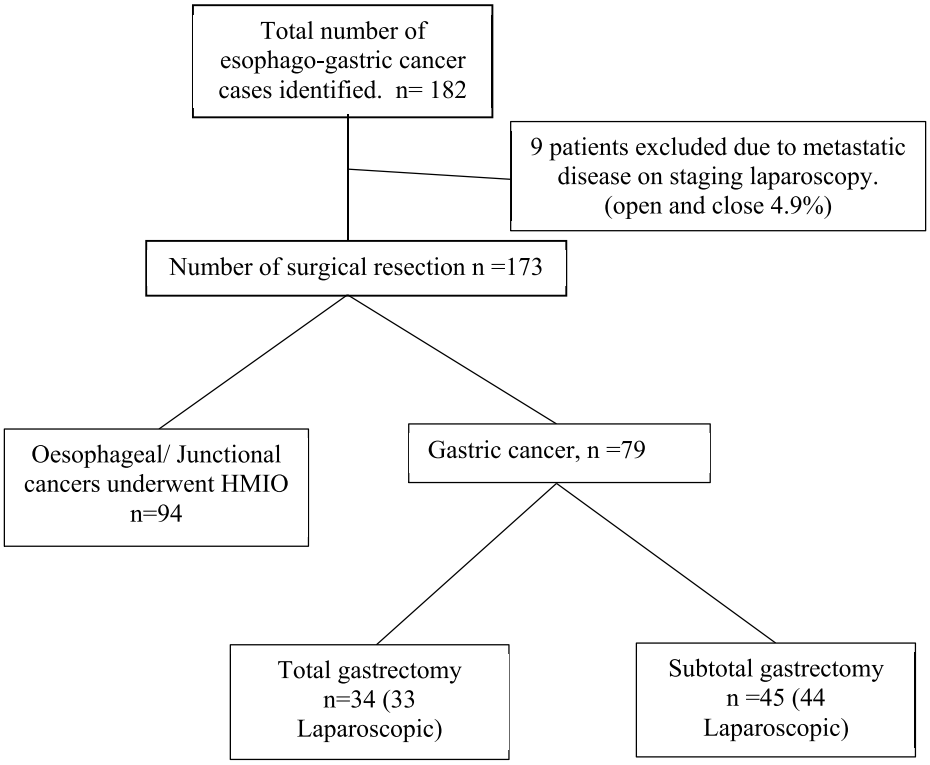

Fig. 1. Study flowchart.

patients. Two patients developed postoperative pneumonia treated with antibiotics, another two patients had moderate sized pleural effusion which was treated by drainage in one and conservatively in the other, and the fifth patient developed respiratory failure which was managed by continuing ventilation and respiratory support.

Anastomotic leaks occurred in five patients (2.9%), two in the gastrectomy group and three in the esophagectomy group with no statistical difference (p = 0.597). Anastomotic leaks after esophagectomy were treated by endoscopic insertion of covered stent, insertion of chest drain and laparoscopic insertion of feeding jejunostomy tube in two patients and the third patient was treated by total parenteral nutrition (TPN) and nil by mouth for 4 weeks. Complete healing of leaks was confirmed by contrast imaging in the three patients. In the gastrectomy group, one patient had subclinical leak after laparoscopic total gastrectomy and successfully treated conservatively, the other patient required to have further surgery when diagnosed with a leak after subtotal gastrectomy and subsequently died in ITU.

Neurological complications occurred in six patients as detailed in Table 2.

Postoperative bleeding occurred in two patients. One patient had bleeding from intercostal vessels at the site of chest drain, and the other developed omental bleed after laparoscopic subtotal gastrectomy, both requiring further surgery.

Significant chyle leak after esophagectomy occurred in two patients, one was diagnosed three days after surgery and the other was readmitted one week after discharge because of shortness of breath. Both patients had thoracotomy and ligation of the thoracic duct.

Other complications which required further surgery included, small bowel obstruction, port-site hernia, and small bowel fistula. Details of post-operative complications are shown in Table 2.

Median pain score on the first postoperative day was 5 and 3 for esophagectomy and gastrectomy patients respectively and this has been improving gradually onwards.

The median hospital length of stay for the whole cohort was 6 days but this was significantly reduced in the last five years with a median of 5 (4–7) days compared to the first five years which was 8 (7–10) days and this was statistically significant (P = 0.004). Fig. 2 shows LOS over the studied period.

Hospital readmission in 30-day period after discharge occurred in seven patients (4%). Four patients were admitted because of non-specific abdominal pain and were treated conservatively. The other three patients had complications which were diagnosed after discharge and readmission, namely, anastomotic leak presented by sudden pneumothorax, chyle leak presented by shortness of breath and discharging wound infection.

Postoperative mortality at 30 and 90-day were the same at 2.9%. Five patients have died, three after gastrectomy and two after esophagectomy and this was statistically different between the two groups (P = 0.001). One of the patients who were treated by neoadjuvant chemoradiotherapy, has developed sudden shock and hypotension after esophagectomy which was resistant to resuscitation and patient died. Post-mortem examination revealed intact anastomosis and healthy-looking conduit but signs of pneumonitis and pericarditis. The other esophagectomy patient has died from aspiration pneumonia. The leading cause of death for the three gastrectomy patients were, massive stroke in the first, kidney and bowel infarction in the second, and anastomotic leak in the third.

Histologically examined lymph nodes ranged from 5 to 42 with a median of 18 lymph nodes. There was no statistical difference in the yield between esophagectomy and gastrectomy patients (P = 0.657). Longitudinal resection margins were histologically positive for cancer in three esophagectomy and two gastrectomy patients (2.9%), but circumferential margins were involved in 23 oesophageal and 5 gastric patients (16.2%). Table 3 shows surgical and histological characteristics of included patients.

One-year survival after esophagectomy for cancer was 89% (84 patients) and 85% (67 patients) after gastrectomies.

Table 2
Post-operative complications.

Complications	Type of Surgery	Number (%)	Clavien-Dindo
G.I.T:			
Anastomotic leak	HMIO	3 (1.7%)	3a
	Lap. Subtotal gastrectomy	1 (0.6%)	4a
	Lap. Total gastrectomy	1 (0.6%)	3a
Small bowel fistula	HMIO	1 (0.6%)	3b
Small bowel obstruction	Total gastrectomy	1 (0.6%)	3b
Port-site hernia:	Lap. Subtotal gastrectomy	1 (0.6%)	3b
Neurologic:			
TIA	HMIO	2 (1.2%)	2
	Lap. Subtotal gastrectomy	2 (1.2%)	2
Confusion	HMIO	1 (0.6%)	1
Depression	Lap. Total gastrectomy	1 (0.6%)	1
Pulmonary:			
Pneumonia	HMIO	2 (1.2%)	3a
Respiratory failure	HMIO	1 (0.6%)	3b
Pleural effusion	HMIO	2 (1.2%)	2
Bleeding:			
Intercostal vessels	HMIO	1 (0.6%)	3b
Omental vessel	Lap. Subtotal gastrectomy	1 (0.6%)	3b
Chyle leak	HMIO	2 (1.2%)	3b
Cardiac dysrhythmia	HMIO	2 (1.2%)	2
Wound infection:			
	HMIO	1 (0.6%)	2
	Lap. Subtotal gastrectomy	1 (0.6%)	2
Total		27 (15.6%)	

4. Discussion

Within this study, postoperative complications were identified in 11.4% and 19% of gastrectomy and esophagectomy patients respectively. This rate of complications is much lower than that seen in other studies reported in the literature [12,13]. On closer examination, post esophagectomy pulmonary complications dominate the difference in complications overall between the literature and this study. Traditionally, many factors contribute to the increased rate of pulmonary complications after esophagectomy [14]. These include, operating on relatively elderly patients, deflation of one lung for a period of time and patients lying in bed for prolonged periods of time, occasionally measured in days [15]. With the recognition that early mobilisation is the key intervention to reduce pulmonary complications [16], most studies examining ERAS after esophagectomy recommended that, without providing clear practical steps to achieve early mobilisation in this particular group of patients [17,18]. There are many obstacles to early mobilisation following resectional gastro-oesophageal surgery. One obstacle could be the use of opioid based patient-controlled analgesia (PCA), which not only causes respiratory depression but also drowsiness and sometimes confusion making it more unsafe to walk patients [19]. Regional analgesia via thoracic epidural catheters has also some limitations [20]; they do not work effectively in a significant number of patients and therefore patients are usually given more opioids. In addition, thoracic epidurals sometimes cause numbness of lower extremities, hypotension and urine retention that prolongs urinary catheterisation and adds to the hindrance for mobility. Chest drains are traditionally connected to under-water seal bottles which need to be carried at a lower level than the patient's waist and this also causes significant hindrance to walking.

In our study, we have introduced changes that have made early mobilisation both practical and feasible. We replaced the thoracic

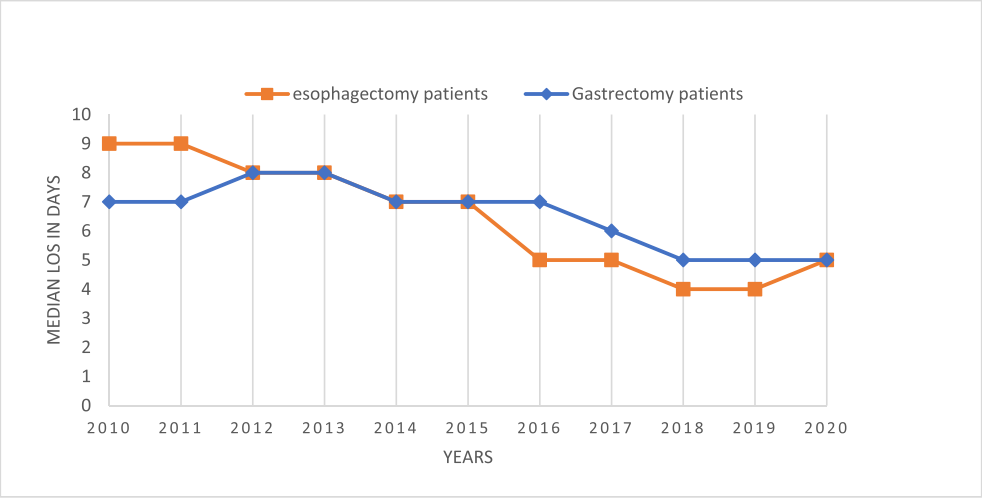

Fig. 2. Median length of stay.

Table 3
Surgical and histological characteristics.

Type of Surgery:	HMIO	94/94 (100%)
	Lap total gastrectomy	33/79 (41.8%)
	Lap subtotal gastrectomy	44/79 (55.7%)
	Open gastrectomy	2/79 (2.5%)
Histological stage:	Stage 1	14/173 (8.1%)
	Stage 2	42/173 (24.3%)
	Stage 3	108/173 (62.4%)
	Stage 4a	9/173 (5.2%)
Lymph node harvest	>15	131/173 (75.7%)
	<15	42/173 (24.3%)
	Median	18 Lymph nodes
Involved resection margins:	Longitudinal	5/173 (2.9%)
	Circumferential	28/173 (16.2%)
Intraoperative blood transfusion		3/173 (1.7%)
Laparoscopy (open) and close		9/182 (4.9%)

epidural catheter with two subcostal catheters inserted under vision above and below the transected rib, and bupivacaine was continually infused for 2–3 days. The numeric pain score for patients supports the effectiveness of this method in achieving adequate analgesia. We also replaced the under-water seal bottle with a one-way valve that allows air and fluids to be drained in one-way out of the chest (Heimlich valve) [21] and which is connected to a bile bag. The use of Heimlich valve connected to a bile bag immediately removed the hindrance of the under-water seal bottle and facilitated early mobilisation. In addition, opioid-based analgesia is not routinely used and reserved only for the minority of patients who do not completely respond to our regimen of analgesia (bupivacaine intercostal block, IV paracetamol ± Diclofenac supp.). The avoidance of opioids has removed the confusion and drowsiness side effects, thus aiding early mobilisation.

The effectiveness of using a Heimlich valve in our study was compatible with what has been shown in the literature in relation to safety and practicality of this technique in chest surgery [21]. We introduced the technique carefully, initially replacing the underwater drainage system with the valve on the second postoperative day then gradually moving to use of valve alone immediately at the end of surgery, which became our standard protocol during the study period. This change was implemented after we confirmed the efficacy and safety of the valve.

Beside the avoidance of pain from laparotomy incision by performing HMIO with laparoscopic abdominal part, we found the above measures compatible with early mobilisation and allow to actively walk patients from day one. The authors believe that these interventions are the main reasons for the reduced post-esophagectomy pulmonary complications.

In general, many complications in surgery are the result of our own interventions, therefore, the authors believe that simplifying surgery is a key to reduction of complications. Albert Einstein once stated, "Everything should be made as simple as possible, but not simpler". Applying this principle to esophagectomy patients, we omitted routine feeding jejunostomy and pyloroplasty more than ten years ago. Pyloroplasty was always controversial in the literature but many studies have shown no increased risk of anastomotic leak in absence of pyloroplasty [22,23]. On the other hand, pyloroplasty has its own complications which can be avoided. In the absence of pyloroplasty, we routinely use Metoclopramide and although its prokinetic effect on the bowel is debatable but its effect on relaxing the pyloric sphincter and facilitating stomach emptying is established [24].

Routine peri-operative insertion of feeding jejunostomy was advocated to ensure adequate nutrition, because many patients are already malnourished, and for those who develop anastomotic leak [11]. Many alternatives for establishing good nutrition are available and are less invasive. These include oesophageal stenting, high-calorie drinks and naso-jejunal feeding tubes. Also, as the rate of anastomotic leak is around 3% in our study, we do not believe that this low rate would justify adding this invasive procedure for all patients when it is unnecessary for most of them. Furthermore, as the abdominal part of the operation is performed laparoscopically, adhesions are minimised and feeding jejunostomy can be inserted laparoscopically for those who require it after surgery.

Some studies have reported a relatively high incidence of duodenal stump blow out after laparoscopic total and subtotal gastrectomy [25]. We did not observe this complication in any of our gastrectomy patients. At the beginning of our experience in laparoscopic gastrectomy in 2005, we encountered this complication and then changed our practice where we always ensure that at least 2 cm of duodenal stump is dissected free before transection and we routinely use vascular stapler with three rows of staples on each side.

In the esophagectomy group, only three patients had neoadjuvant chemoradiotherapy as part of oncology trial. Our Multidisciplinary Team (MDT) decision making was changed on the finding that the potential benefits of neoadjuvant chemoradiation were outweighed by the complications seen. One of these patients died because of sudden unexplained cardiac shock and post-mortem examination revealed pneumonitis and pericarditis, the second patient had recurrent pneumonitis continued for 4 years and the third patient developed delayed heart

problems which could not be explained by other diseases.

Centralisation of esophago-gastric resections has resulted in improvement in outcome in certain areas [9], but the focus on volume might have diluted other factors and contributions which could be more important in improving outcome. It is debatable in the literature; what is more important, surgeon's volume or unit volume [6]. Also, there is no agreement as to what constitutes a high-volume unit or what is the accepted number of yearly resections per surgeon [7,9,26]. This study shows that an individual surgeon performing high volume resectional surgery can produce excellent results and would support the philosophy that individual volume may be more relevant than unit volume as long as the hospital has adequate infrastructure to deal with complications and interventions. It has been advocated that other surrogate interventions would be a factor in determining the surgical experience of the unit [27]. The authors and the unit routinely perform high-volume giant hiatus hernia repairs, redo anti-reflux surgery and bariatric surgery, which all act as surrogate experience for esophago-gastric resections.

Studies have shown that physiological measures of patients including postoperative analgesic requirements, post-surgical recovery and hospital length of stay are partly related to doctor-patient communication and relationship [28,29]. Our study relates to a single-handed resectional surgeon which gives patients the benefit of seeing the same surgeon in every consultation and this builds up a stronger relationship and better communication. This doctor-patient relationship translates into ability to give better reassurance and relief of anxiety after surgery which consequently would lead to reduction of analgesic requirements and quicker recovery.

The study has number of limitations, including the small size of the cohort which might affect its statistical power. It is also a retrospective study which could be open to selection bias, but we minimised this by analysing a prospectively maintained database and evaluated consecutive series of patients undergoing esophagectomy or gastrectomy without any exclusions.

5. Conclusion

We conclude that good outcomes after oesophageal and gastric resections can be produced in small-volume units. It appears that there are other factors which might be more relevant to outcomes than the unit volume or its size. These include overall surgeon's experience in the field, ability to adhere to protocols and procedures which facilitate early mobilisation, dedication, continuous improvements and building strong relationship with individual patients.

We believe that the outcome results of small volume units should be reviewed and compared with national standards and exceling units should be promoted. There is scope for further research to establish the key elements which makes a unit better than other.

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Ethical Approval not needed as it was a Retrospective observational study.

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None.

Author contribution

Concept of the paper- Mr Ahmed Hassn.

Data Collection – Mr Ahmed Hassn.

Data analysis and Interpretation – Mr Ahmed Hassn, A Gupta, M Ramadan.

Drafting the article- Mr Ahmed Hassn, A Gupta, M Ramadan.

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Guarantor

The Guarantor is the one or more people who accept full responsibility for the work and/or the conduct of the study, had access to the data, and controlled the decision to publish. Please note that providing a guarantor is compulsory.

Mr Ahmed Hassn.

Declaration of competing interest

None.

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