Overview on Gastric Cancer

Chapter 1

Gastric Cancer and Bariatric Surgery

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1. Introduction

In recent decades, obesity has become a major public health problem. Based on the WHO's report, the prevalence of the obesity has increased more three times than what it was in 1975s [1] Moreover, it is among the first ten leading risk for worldwide death [1,2]. Substantially individuals are considered obese when their Body Mass Index (BMI) ≥30 kg/m2. Regarding to WHO's classification, obesity is classified as class I for a BMI between 30 and 34.9 kg/m^2, class II for a BMI between 35 and 39.9 kg/m^2, and class III for a BMI ≥ 40 kg/m2(extreme obesity) [3]. Raised BMI is a major risk factor for many deadly problems, such as cancers, diabetes and cardiovascular disease [4,5]. This issue would project poorer outcome for obese individuals. There is a direct relationship between increasing the class of obesity and increasing the risk of death [5,6]. Median survival for individuals with class I obesity is reduced 2-4 years and this reduction for extreme cases is 8–10 years [5]. It is these comorbid conditions that play the main role in reducing the survival time in this population [5,6].

Quite a few options are available for managing obesity. Life style modification, pharmacological interventions and in severe cases bariatric surgery or metabolic surgery are among the most common therapeutic choice that we have [7]. Bariatric surgery causes long-term weight loss in sever obese individuals [7]. Overall this type of operation is indicated for 2 groups of obese people. First group is the individuals who have BMI ≥40, the second group is the cases who have BMI≥35 and comorbid conditions [8]. Unfortunately, there is an age-related restriction for this intervention and all cases who are the candidate for the surgery should be aged

between 18 and 60 year-old [8].

Bariatric surgery can reduce the harms that originate from the major comorbid problems and decrease the mortality rate in this population [9,10]. In many countries the operation is considered as the established procedure for the remission of T2DM for obese patients. Furthermore, it may have protective effect on incidence of different cancers. A meta-analysis of 13 studies (54,257 participants) points out the significant reduction in cancer risk [11]. In addition, several studies have confirmed that this surgical intervention can facilitate the control of other obesity-related disorders, including T2DM cardiovascular diseases and dyslipidemia [9,10,12].

Different surgical techniques are existing for metabolic surgery. Roux-en-Y gastric bypass (RYGB), adjustable gastric banding(AGB), sleeve gastrectomy, Biliopancreatic diversion (BPD), biliopancreatic diversion/ duodenal switch [13] and gastric mini bypass(GMB) [14] are the most well-known procedures. Generally, the laparoscopic approaches are more preferred [15]. In addition, BMI, Age, Gender, Body fat distribution, level of dyslipidemia, Gastroesophageal reflux disease, T2DM are other factors that affect the way of approach [8].

Because Bariatric surgery changes the structure and anatomy of the gastrointestinal tract and most especially the stomach of patients, it is hypothesized that this operation may lead to some complications including malignancies in this part of the body [16]. Although studies have shown a reduction in the incidence of cancer in obese patients due to this surgery, [11] there are numerous case reports of gastric cancer incidence in the long-term follow up of these patients. Our goal in this chapter is to examine the relationship between bariatric surgery and its effect on gastric cancer.

2. Gastric Neoplasms after Bariatric Surgery

As noted above, obesity can be a risk factor for many malignancies. It is believed that weight loss has positive effect on improving health condition in obese cases and what is more it reduces the risk of cancer. Since bariatric surgery leads to weight loss, a dramatic reduction in the incidence of neoplasms has been observed and it reduces the mortality due to malignancies [10,17,18]. According to some studies that evaluated the effect of bariatric surgery on cancer-related mortality in a great population of obese individuals, it was established that such intervention would reduce the cancer-related mortality approximately in 46-60% of this population [10,17]. An important point is that weight loss in patients does not affect significant better outcome for cancer associated survival therefore what we see as a positive effect of weight loss is reducing the incidence of malignancies in obese individuals [17].

Globally, 28 studies describing 31 patients were found. Characteristics of each case have been shown in tables 1 and 2. Twenty-two patients were female (71%) and nine were

male (29%). The mean age at the time of admission was 56.5 years (ranged 37-74). Mean time interval between cancer diagnosis and bariatric surgery was 10.03 years (ranged 6months to 41 years) [19-46].

Of all the patients, fourteen underwent RYGB [19-31], four underwent loop GB[32-35], seven underwent VBG [22, 36-40], three underwent gastric banding[41-43] and three had sleeve gastrectomy(SG). [44-46] From all found pathologies, gastric adenocarcinoma was reported in 27 patients (87.1%), one case with large B cell lymphoma(3.2%) [22], one with GIST (3.2%) [22] and for two patients(6.4%) type of the tumor was not mentioned [39,42].

In cases underwent gastric bypass, thirteen had lesions in excluded stomach (72.2%) [19-23,25-27,31, 33-35], five in gastric pouch (27.7%) [24, 28-30, 32] . For patients who had a history of VBG, three tumors were located in gastric pouch [36,37,40], three had tumor in distal stomach (pylorus) [38,39] and there was a gastro intestinal stromal tumor (GIST) in this group too [22]. In cases who underwent Gastric banding as bariatric procedure two patients had their lesion in gastric pouch [41,42] and the other patient's lesion was found in lesser curvature of the stomach [43]. cancer site for patients with previous sleeve gastrectomy, several anatomical sites such as lesser curvature of the cardiac region [44], gastroesophageal junction [45] and gastric antrum [46] were reported.

Unfortunately, reported symptoms have been inconclusive for gastric cancer and it may postpone the early diagnosis. Moreover, among admitted symptoms, weight loss [19,20,26, 29,36,38,39], abdominal pain [20,21,25-27,31,46], epigastric pain [23,30,33,35,40,41] and dysphagia [22,29,32,39,44,45] have been reported more commonly. Non-specific symptoms might have led to cancer diagnosis in advance stages. In three studies, nothing reported about the presence of nearby tissue invasion and metastasis. [28,35,43] On the other hand, For 18 patients(58%), presence of tissue or lymph node invasion and metastasis have been mentioned [20,21,23-26,28-31,33,36-41,45].

Preoperative Esophago-gastro-duodenoscopy (EDG) (before bariatric surgery) was performed only in 9 patients [20,21,23,28,39,42-44,46]; in three cases helicobacter pylori (HP) was positive [20,28,42] however for the rest no abnormalities were mentioned.

Only in four study, upper gastrointestinal (GI) examination by endoscopy or upper GI series was not reported prior to cancer diagnosis [23,25,27,33]. Among the others, in five cases no abnormalities have been observed. [19,20,31,35,42] In these patients, three cases underwent RYGB [19,20,31] and one case underwent loop GB [35]. In all of the four patients, neoplastic lesions located in the excluded stomach which impossible to reach by common endoscopic devices [19,20,31,35]. Gastric ulcer was found in 8 cases, which would be a site for presence of the malignancies [21,22,26,29,37,39,41,46]. For fourteen patients, EDG was effective in finding suspected neoplastic lesion. [26,28-30,32,34,36,38-40,44,45] Presence of

HP in post bariatric surgery surveillance has been reported in two cases [20,37]. Moreover, intestinal metaplasia (IM), distal metaplasia and atrophy were observed [36,37].

Table 1. Cases with gastric cancer after gastric bypass

Author and year of publication	sex	Age	Years after bariatric surgery	Surgical technique	Admission symptoms	Site of cancer	Type of tumor	Treatment
Ahmad et al , 2017(19)	F	74	41 yrs.	RYGB	early satiety, weight loss and left upper quadrant abdominal pain	Excluded stomach	GA	NA
Corsini et al , 2006(20)	M	57	4 yrs.	Banded RYGB	abdominal pain and excessive weight loss	Excluded stomach	GA	Palliative therapy
Courtney et al , 2014(21)	F	56	9 mo.	RYGB	Abdominal pain, nausea and fever	Excluded stomach	GA	Chemotherapy
De Roover et al , 2006(22)	M	66	3 yrs.	RYGB	Fever and left shoulder pain with anemia	Excluded stomach	diffuse large B-cell lymphoma	Distal gastrectomy and chemotherapy
Escalona et al ,2005(23)	F	51	8 yrs.	RYGB	Epigastric pain, nausea	Excluded stomach	GA	Total gastrectomy
Fleetwood et al ,2016(24)	M	73	NA	Banded RYGB	satiety	Gastric pouch	GA	NA
Harper et al , 2007(25)	F	45	1 yrs.	Banded RYGB	abdominal pain, distension and constipation	Excluded stomach	GA	palliative decompressive gastrostomy tube; palliative chemotherapy and radiotherapy.
Magge et al , 2015(26)	M	69	28 yrs.	RYGB	Syncope,abdominal discomfort, nausea, appetite loss and weight loss	Excluded stomach	GA	Neoadjuvant chemotherapy and subtotal gastrectomy
(41)	F	NA	25 yrs.	RYGB	abdominal distention and progressive weight loss	Excluded stomach and proximal duodenum	GA	Surgery: subtotal gastrectomy, proximal duodenectomy. chemotherapy and radiotherapy
McFarland et al , 2015(27)	M	68	7 yrs.	RYGB	Generalized abdominal pain and constipation	Excluded stomach	GA	NA
Ribeiro et al , 2013(28)	M	52	2 yrs.	RYGB	Pallor and microcytic anemia(lab tests)	Gastric pouch	GA	Total gastrectomy and chemotherapy
Sun et al , 2008(29)	M	65	5 yrs.	RYGB	Dysphagia ,heartburn and weight lost	Gastric pouch	GA	Palliative therapy

Toledano et al , 2005(30)	F	52	5 yrs.	RYGB	epigastric pain	Gastric pouch	GA	Chemotherapy , radiotherapy and trans hiatal esophagopouchectomy
Watkins et al , 2007(31)	M	44	18 yrs.	RYGB	upper abdominal pain, emesis, and dehydration	Excluded stomach	GA	Surgery and chemotherapy
Khitin et al, 2003(33)	F	57	22	Loop GB	Epigastric pain and mild distention	Excluded stomach	GA	Resection of distal two third of gastric remnant and loop gastrojejunostomy with proximal gastric
Raijman et al, 1991(35)	F	38	5	Loop GB	Malaise, epigastric pain, low fever and dark stool	Excluded stomach	GA	Distal gastrectomy
Babor et al ,2006(32)	F	61	29	Loop GB	Dysphagia, nausea, and vomiting	Pouch	GA	Roux-en-Y esophagojejunostomy
Lord et al, 1997(34)	F	71	13	Loop GB	Anemia	Excluded stomach	polypoid adenocarcinomas	distal gastrectomy

RYGB= Roux-en-Y gastric bypass; GB= gastric bypass; GA= gastric adenocarcinoma; GIST= gastrointestinal stromal tumor; NA= not available

Table 2. Cases with gastric cancer after bariatric proceduresother than gastric bypassing methods.

Author and year of publication	sex	Age	Years after bariatric surgery	Surgical technique	Admission symptoms	Site of cancer	Type of tumor	Treatment
De Roover et al,2006(22)	F	47	12 yrs.	VBG	Dysphagia and vomiting	GIST	GIST	Total gastrectomy
Chebib et al, 2007(36)	M	60	15 yrs.	VBG	Massive upper GI bleeding and weight loss	Pouch	GA	Total gastrectomy
Jain et al, 2003(37)	F	67	15 yrs.	VBG	Anemia and weight loss	Pouch	GA	Total gastrectomy
Zirak et al, 2002(40)	F	52	2 yrs.	SR VBG	Epigastric pain anorexia and nausea	Pouch	GA	Total gastrectomy , splenectomy and lymphadenectomy
Papakonstantino et al, 2002(38)	F	57	6 yrs.	VBG	Vomiting, weakness, and weight loss	Pylorus	GA	Whipple pancreaticoduodenectomy
Scozzari et al, 2014(39)	F	50	8 yrs.	VBG	vomiting, dysphagia and weight loss	Neo pylorus	GA	palliative digiunostomy, chemotherapy, radiotherapy and surgery
	F	56	3 yrs.	Mac Lean VBG	dysphagia, emesis, and weight loss	Neo pylorus	NA	total gastrectomy with Roux-en-Y esophagojejunal anastomosis and D1 lymphadenectomy and post-surgical chemotherapy
Hackert et al, 2004(41)	F	62	10	Gastric banding	Epigastric pain	Pouch	GA	Near-total gastrectomy
Stroh et al, 2008(42)	F	65	2.5	Gastric banding	Hematemesis	Pouch	NA	NA
Orlando et al, 2014(43)	F	37	0.5	Gastric banding	NA	Lesser curvature	GA	Total gastrectomy

Erim et al, 2015(44)	F	52	4	SG	dyspepsia	lesser curvature of the cardiac region of the stomach	GA	surgery
Masrur et al, 2016(45)	F	44	4	SG	intense dysphagia	gastroesopha geal junction	GA	total gastrectomy with a roux-en-y intracorporeal esophagojejunostomy
Vladimirov et al, 2017(46)	F	47	4	SG	nonspecific abdominal pain and back pain	Gastric antrum	GA	Total gastrectomy with Roux-en-Y esophagojejunostomy and D2 lymphadenectomy

VBG = vertical banded gastroplasty; SRVBG= silastic ring vertical banded gastroplasty; GA= gastric adenocarcinoma; SG= sleeve gastrectomy; GIST= gastrointestinal stromal tumor; NA= not available

3. Gastric Cancer after Bariatric Surgery: Pathophysiologic Points of view

Bariatric surgery reduces the cancer risk, nevertheless, gastric cancer would rarely be seen after this operation [11]. Several hypothesized etiologies are existing. Such etiologies try to explain this condition based on the fact that the bariatric surgery affect the anatomy of GI tract and as a result it can change the blood supply, [47,48] increase the risk of food and acid stasis, [48] and in some way it has influence in bile reflux [49-52]. Overall, despite protective effect of bariatric surgery against malignancies, it may increase the precancerous tissue modifications in long term. Although the mechanisms of tumorigenesis after bariatric surgery are not well understood, several theories are suggested for explaining this rare event after this type of intervention. In this part we are going to talk about them:

Incidence of gastric cancer was reported both in gastric pouch and bypassed stomach after RYGB. Even though the distal part of the stomach is unexposed to the exogenous etiologic factors of gastric cancer after operation, the incidence of cancer in this site was higher [19-31]. One explanation can be bile reflux into bypassed stomach. Exposing to bile for a long period of time would lead to precancerous lesions such as IM and dysplasia or somehow, it can increase the rate of tumorigenesis reactions [49-52]. Kuga et al observed the bile reflux in 24 of 35 (68.6%) bypassed stomachs. Moreover, they pointed out that the post-surgical rate of upper GI pathologies such as different types of gastritis (erythematous, erosive, hemorrhagic erosive, and atrophic), in excluded part of stomach is higher than what it was in preoperative assessments in same cases [52]. Sundbom et al found duodenogastric bile reflux after surgeryin 36% of the patients [53]. Swartz et al suggested that it is bile reflux that cause chronic pain after RYGB [54]. Safatle et al pointed out that the rate of cells proliferation in the bypassed stomach increased. Simultaneously, the rate of apoptosis diminished in long term. Abnormal tissue turnover in bypassed stomach may give a rise to gastric cancer in patients who underwent RYGB [55].

In loop gastric bypass, similar pathophysiology as RYGB is mentioned. After this type of surgery, the prevalence of metaplastic and dysplastic epithelial changes is high even higher than RYGB. Moreover, in bile reflux may play a role in creating malignancies in bypassed part

of stomach [48].

In gastric banding procedures, gastric epithelium irritation due food, exogenous carcinogens and gastric acid stasis can be a trigger for cascade of carcinogenic reactions in the stomach [48]. However, several other mechanisms are suggested either. Erosive effect of band on stomach alongside with its effect on starting inflammatory reactions due to its exogenous nature would be another explanation [37,41]. At last but not least, the effect of gastric band on increasing the internal pressure in restricted areas, may affect blood flow and induces ischemia for this part. Therefore, metaplastic changes would be seen in epithelium of this section and these tissue transformations may be starting point for following neoplasms in long term [47,48].

Preoperative examination of upper GI and its controversies

Upper GI examination prior to bariatric surgery, may be an effective procedure in diagnosing cancerous and precancerous lesions. The importance of stomach cancer in candidates for bariatric surgery is that surgeons should be aware of it, if it exists before surgery. Because presence of gastric neoplasms will change the treatment plan and may as well change the severity and complexity of the post-surgical complications. Therefore, it seems that examination of stomach before surgery is indispensable. Endoscopy is a well-known method for observing upper gastrointestinal tract. EGD examination, would reveals various pathologies,associated with the upper gastrointestinal (GI) tract, including different types of gastritis, [56-62] hiatal hernia, [57,58,61,62]. Barrett's esophagus, [58,61] gastric polyps, [56,57,60,61] HP, [56-61] gastric ulcer, [57,59,60,62] duodenal ulceration, [57, 60, 62] IM, [56, 57, 60] lymphoid hyperplasia, [59] granulomatous disease, [56,60] collagenous disease, [56] dysplasia [57] and malignancies such as GISTs, [56,60-62] gastrointestinal autonomic nerve tumor (GNAT), [56] lipomas, duodenal carcinoid, [62] and gastric carcinoid [57]. Gastritis, hiatal hernia, Barrett's esophagus, HP are among the most common pathological findings in pre-operative EDG [56-63].

Seldom do these pathologies lead to major modification in therapeutic plans [62, 64, 65]. Due to this reason and cost-effectiveness issues some authors are disagreeing with the routine preoperative assessment of patients [64]. Somehow, this idea is supported by American Society for Metabolic and Bariatric Surgery guideline [66]. Based on current guideline, preoperative EDG is indicated for the patients who have symptomatic GI tract disorder [66]. However, their recommendation is inconsistent with what American Society for Gastrointestinal Endoscopy Standards of Practice Committee has suggested for preoperative assessment of patients for bariatric surgery [67].

In the other hand, the main reason why it is necessary to have done EDG is due to lack of strong association between EDG findings and patients symptoms, most especially

in asymptomatic cases. [68,69] Hence, some major condition such as malignancies will be neglected and may cause much more complex situation for surgeons. Dietz et al suggested preoperative abnormalities of upper GI tract such as HP, gastric atrophy and IM may cause post-surgery complications such as gastric tumors in long-term follow up [59].

4. Prevalent Types of Gastric Tumors in Preoperative upper GI assessment

Among different types of gastric tumors, mesenchymal tumors, specially GISTs, are the most reported in preoperative assessment. It is rare finding in EDG and its prevalence was ranged 0.2-1% of operation candidates in different studies [56-63]. Furthermore, several studies have reported the incidental finding of some lesion such as GIST (mostly) during the bariatric surgery [70-73]. Walędziak et al, found GIST in 1.28% of cases which, seems the highest prevalence [70]. Moreover, reports indicate that the prevalence of GIST among obese population is much higher than general population [71,74]. Based on current guidelines the GIST lesions with diameter of ≥2 cm should be resected [75,76]. Managing lesions smaller than 2cm is controversial. Based on Canadian guideline on managing GISTs, due to its metastatic nature, even lesions smaller than 1 cm must be resected [77]. Chiappetta et al have recommended that for obese cases who will undergo bariatric surgery, GIST smaller than 2cm in diameter would not cause any modification in treatment process and what is more,LSG or RYGB with laparoscopic wedge resection, both can be safe and effective options [71]. After operation, long term follow up should be considered in order to rule out the recurrence or metastasis [75,77,78].

Presence of other types of tumors in preoperative examinations or during the surgery is uncommon. Other mesenchymal tumors such as lipomas and leiomyoma, gastrointestinal autonomic nerve tumor (GANT), carcinoid tumor, mucosa-associated lymphoid tissue (MALT) are among this type. Some these tumors are sporadic findings in the studies that have checked different types of upper GI tract related pathologies before or during the operation. Other above mentioned types have been reported as case reports. Although usually originating in gastrointestinal (GI) tract (mostly stomach), they make a small percentage of tumors related to this part of the body. Rarely do these kind of lesions become symptomatic. Despite silent and asymptomatic nature of these tumor a group of them such as GANT and carcinoid can metastasize to other parts of the body even in their most benign state. So they may lead to serious postoperative problems in undetected case [57,62,79-84].

Pathological changes inside the GI tract must manage properly in patients who are candidate for bariatric surgery. Gastric polyps and intestinal metaplasia are two well-known forms of these pathologies [22]. Here we are going to explain these two briefly:

4.1. Gastric Polyps

Gastric polyps are the abnormal growth of epithelial tissue or subepithelial tissues in stomach [85]. Different kinds of them are well-known such as fundic gland polyps, hyperplastic polyps, adenomatous polyps, fibroid polyps and hamartomatous polyps. Adenomatous polyps are known as absolute precancerous lesions and the risk of subsequent malignancy is the highest in this type of polyps. Besides hyperplastic polyps and hamartomatous polyps have associated with gastric cancer; but, they convoy low risk of cancer. Rarely can a tumor be originated from fibroid polyps and fundic gland [86]. For adenomatous polyps, polypectomy and one-year follow up is established managing procedure. For other types, with lower risk of malignancies, more examinations are critical in order to determine whether polypectomy is indicated or not [86]. Gastric polyps have been found in 0.6% to 6% of obese cases undergoing bariatric surgery in different studies. Unfortunately, most of the studies the histologic feature of the polyps was not mentioned [56,57,62]. On the other hand, two studies reported that all of the diagnosed polyps were hyperplastic [62,87]. For managing gastric polyps in bariatric surgery applicants it is suggested to take biopsies to rule out the malignancy and determine the histologic pathology. Furthermore, if RYGB or MNG is considered, remnant gastrectomy would be a safe and protective option in order to reduce risk of the post-surgical compilations especially cancer [62].

4.2. Intestinal metaplasia

Intestinal metaplasia (IM) is a pathological tissue transformation prior to gastric adenocarcinoma. However, rarely does it change to neoplasm. [88] HP, smoking and chronic bile reflux are well establish risk factors of the IM [89]. Several classifications are known for IM. In classification by Matsukura *et al*, IM is classified into two classes, based on existence of intestinal enzymes. If existing, it is called complete IM. Incomplete IM indicates opposite condition in what we see in complete IM about the presence of intestinal enzymes [90]. Gastric cardia and distal part of the stomach are common locations that IM is found. As well, it is a usual finding in biopsies which were taken from distal stomach, most especially in geographical regions, known for higher risk of gastric cancer, such as eastern Asia, Latin America, and Eastern Europe [91,92]. In an established sequence pathological tissue changes, grade of transformation prior to gastric adenocarcinoma can be understood: non-atrophic gastritis, multifocal atrophic gastritis, IM, and dysplasia [93].

Presence of IM in patients do not need any surveillance, unless the patents have some other known risk factor of gastric cancer, such as family history, geographical site and racial background presence of incomplete type of IM [88,94].

High grade dysplasia is known as a carcinoma in situ. Dysplastic area in stomach might be found in areas with IM. However, managing dysplasia is based on its grade. For high

grade and low grade, it can be a surgical resection and endoscopic follow up, respectively [89,94,95].

Despite the protective effect of bariatric surgery on cancer incidence, the effect of this procedure on GI tract anatomy may highlight the importance of IM presence in the patients, most especially in patients who will undergo RYGB and MGB procedures. Because in these procedures a huge part of the stomach will become inaccessible after operation. Moreover, bile reflux into excluded part is a known complication of these two procedure [14,74]. As a consequence, in preoperative examination of upper GI, if IM exists in distal stomach, distal gastrectomy alongside with MGB and RYGB would have preventive effect and reduce the risk of gastric cancer after bariatric surgery [74].

5. Conclusion

Since the lack of appropriate studies to investigate the relationship between the incidence of gastric cancer and bariatric surgery, it is hard to find any evidence-based association between these two. Nonetheless, considering presence of gastric cancer cannot be out of mind if a patient has persistent or sever upper GI complaints after bariatric surgery. Post-operative EDG is an effective tool to detect malignant lesions except for patients who undergo RYGB or MNG. Because in these cases anatomical alternation on GI tract, cause some difficulties in assessing excluded part of the stomach. Computed tomography (CT) scan can be an alternative choice for these patients. However, several new devices like double-balloon endoscopy, [96] percutaneous endoscopy, [19,97] virtual gastroscopy [98] are developed but their efficacy has not been approved yet.

The incidence of gastric neoplasm is affected by many risk factors, such as comorbid conditions, racial and geographical elements, socio economic statue behavioral pattern and age. Each of these risk factors has its own role on developing gastric neoplasm [99] and for some of them, their influence may be altered after bariatric on the other hand, age as a risk factor, play an independent role in developing of gastric cancers. several studies indicate that older people had higher risk of gastric cancer [100] and this risk would not decreased even if other risk factors such as Hpylori has been eradicated [101] in addition, the trend of incidence of gastric cancer , from anatomical aspect, has been changed. several studies demonstrated this changes as distal to proximal relocation [102]. this is crucial, basically because in some of the bariatric procedures the proximal part is remained as the functional stomach and if the this areas are affected by malignancies, the remaining part should be exlcuded which finally may lead to lower quality of life. Accordingly, the more the number of operated bariatric procedures, the higher the importance of further comprehension of bariatric procedures-related changes physiologic and pathologic changes of stomach.

Routine preoperative EDG is not suggested by current guidelines, however its usefulness in diagnosing malignant and premalignant conditions was reported by many studies. Moreover, periodic upper GI surveillance of the patients after bariatric surgery would not necessary [100]. Based on our finding, post-operative EDG is performed whenever a patients is admitted with severe complications.

Even though current evidence indicates that not only this intervention reduces the risk of cancer in obese peoplebut also the risk of gastric cancer after it is very low, prospective studies are needed to clarify the long term effects of bariatric procedures on presence of gastric malignancies after this type operation.

6. References

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