

Full Length Research paper

The effect of laparoscopic cholecystectomy on the rate of gastric emptying: A prospective, randomized clinical study

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Following laparoscopic surgery gastrointestinal motility can change to a greater or lesser degree. Although, almost every kind of study performed about laparoscopic cholecystectomy, gastric emptying has been evaluated in a few studies. The aim of this prospective, randomized study is to investigate the effect of laparoscopic cholecystectomy on gastric emptying time. Twenty patients undergoing laparoscopic cholecystectomy (female/male 17/3) and 16 healthy volunteers (female/male 14/2) were enrolled into the study. Following an 8-hour fast, one minute scintigraphic images were obtained in the anterior and posterior projection immediately, and 30, 60, 90 and 120 min after a 500 μ Ci (18 MBq) Tc99m sulphur colloid labelled egg, 2 slices of bread and 150 mL of orange juice ingestion. The gastric half emptying time (T1/2 min) was found while the patient was standing. A significant difference of gastric emptying values was found between the patients undergoing laparoscopic cholecystectomy and the Control group ($p < 0.005$). Gastric emptying of solid meal in patients undergoing laparoscopic cholecystectomy was slower than in the Control group. Although, laparoscopic cholecystectomy is a safe and minimally invasive surgical procedure, it may have an adverse effect on the gastric emptying time. In the early postoperative period, minimal abdominal discomfort and dyspepsia may occur which may be associated with the delay in gastric emptying in patients undergoing laparoscopic cholecystectomy.

Key words: Laparoscopy, gastric, emptying.

INTRODUCTION

Laparoscopic cholecystectomy has become a widely accepted operating method during the past 17-18 years in elective biliary surgery. Numerous advantages, such as less postoperative pain, a diminished adhesion rate, and an earlier return to normal activity, have been attributed to less surgical trauma (Gupta and Watson, 2001). Laparoscopy can have a negative effect on various systems such as the cardiovascular, renal, pulmonary and gastrointestinal systems. Gastrointestinal adverse effects have been well described and investigated in detail. However, to the best of our knowledge, little is known regarding the effect of laparoscopic surgical procedures on the rate of gastric emptying.

A variety of methods, including scintigraphy, ultrasonography, and intubation techniques, have been used to assess gastric emptying in both the clinical and research settings. Each of these methods suffers from disadvantages, including exposure of the subject to low levels of radiation during scintigraphy, difficulty in measuring proximal and distal gastric regions simultaneously by ultrasonography, and the possible disturbances of normal physiology induced by gastrointestinal intubation (Collins et al., 1983; Holt et al., 1986; Read et al., 1983).

Although, scintigraphy has some minimal side effects, it is now widely considered the gold standard method for evaluating gastric emptying. We performed this prospective clinical study using the scintigraphic technique to assess the effect of laparoscopic surgery on gastric emptying.

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Table I. Demographic data of the patients

	Group I (Patients)	Group II (Control group)	P value
Age	50.58±15.85	41.93±12.07	>0.05
Sex	3/17	7/9	<0.05

□ Body mass index

Table 2. Gastric emptying times of the study groups

	Group I (Patients)	Group II (Control Group)	P value
Gastric emptying time (T _{1/2})	90.75±34.48	67.87±20.31	P<0.05*

* Statistically significant.

METHODS

Study subjects

Fifty eight patients, underwent laparoscopic cholecystectomy from January to September 2006. Twenty of them (F/M 17/3) who accepted gastric emptying scintigraphy were included in our study. Sixteen healthy volunteers (F/M 14/2) were selected as control subject.

Written, informed consent was obtained from each subject, and the protocol was approved by the Human Ethics Committee of the Afyon Kocatepe University, Faculty of Medicine.

Protocol

Patients of ASA I-III physical status, were excluded if they had gastro-oesophageal reflux disease, oesophagitis, erosive gastritis, peptic ulcer disease, gastrointestinal obstruction, prior fundoplication, pancreatic diseases, prior gastrointestinal surgery except appendectomy, diabetes mellitus, anorexia nervosa, or took medications that could affect the gastric emptying test (metoclopramide, erythromycin, domperidon, cisapride, calcium canal blockers, gastric acid depressants, antacids with aluminium, antidepressants, narcotic analgesics, or an anticholinergic medication).

Gastric emptying scintigraphy

Gastric emptying scintigraphy was performed in the morning after an overnight fast (Gonlachanvit et al., 2006). A standard test meal (282 kcal) consisting of a 500 µCi (18 MBq) Tc99m sulphur colloid labelled scrambled egg sandwich (two eggs with two pieces of bread) and 150 ml of orange juice was employed. All subjects were instructed to complete ingestion of the meal within 10 minutes. Scintigraphic images were obtained with a large field of view gamma camera using a low energy all-purpose collimator with a 20% energy window setting centred at 140 keV (Philips Medical Systems Gamma Diagnostic Camera, Holland). One-minute images were obtained in the anterior and posterior projection immediately, 30, 60, 90 and 120 minutes after meal ingestion; gastric emptying time (T_{1/2} min) was found while the patient was standing (Table 1).

Statistical analysis

Data were expressed as mean ± SEM. Independent samples t-test and ki square test were used to compare prevalence of gastric

emptying between the patient group and the control group. Data were analysed using SPSS software (version 11.5, SPSS Inc, Chicago, Il, USA). A P value of <0.05 was considered statistically significant.

RESULTS

A total of 20 patients undergoing laparoscopic cholecystectomy were assessed, consisting of 17 women and 3 men, together with a control group of 16 healthy volunteers (14 women and 2 men). There was no significant difference between the two groups (p>0.05). The mean ages of the patients undergoing laparoscopic cholecystectomy and the control group were 50.58±15.85 and 41.93±12.07 years respectively. The mean ages of the study group were greater than that of the control group (p<0.005).

Statistical difference of gastric emptying values between the patients undergoing laparoscopic cholecystectomy and the control group are listed in Table 2. Gastric emptying of solid meal in patients undergoing laparoscopic cholecystectomy was slower than in the control group. It was found that total gastric emptying of the control Group (T_{1/2}) was 67.87 ± 5.07 min., although it was 90.75 ± 7.71 min. in patients undergoing laparoscopic cholecystectomy. There was a significant difference between two groups (p<0.05).

DISCUSSION

Inflammation can cause obvious changes in every kind of body tissue such as gastric tissue. It occurs both directly and indirectly, affecting the enteric and autonomic nervous systems. It has also been shown that inflammation may lead to various structural and/or biochemical changes (Liu et al., 2005).

The intra-abdominal pressure, which is needed for visualization of the surgical field, produces ischemia during insufflation and reperfusion during desufflation, and therefore laparoscopic procedures actually produce ischemia-reperfusion injury. The induction of free oxygen radicals after the restoration of blood flow during the desufflation phase is one of the most important mechanisms of organ dysfunction after laparoscopy (Polat et al., 2003). It has been shown that the severity of the inflammation may affect proximal gastric motility and may change motility and visceral perception (Van der-

Schaar et al., 2001;Kang et al., 2005).

The effects of different surgical procedures on the rate of gastric emptying have been evaluated in humans in a few studies. A variety of emptying studies have been performed with this aim since 1976 (Koksoy et al., 1994;Ibrarullah et al.,1994;Vignolo et al., 2008). Both radionuclide and non-radionuclide diagnostic techniques have been described for this purpose. Non-radionuclide-based diagnostic techniques include both non-invasive tests (upper gastrointestinal barium series, ultrasonography, and breath test for gastric emptying) and invasive procedures (fiber-optic endoscopy, oesophagogastroduodenoscopy, pharyngeal manometry, stationary oesophageal manometry, 24-h pH monitoring, oesophageal biliary reflux monitoring, multichannel intraluminal impedance, and electro-gastrography). Some of these techniques are not well tolerated by patients or not widely available. A complete standardization which can be accepted in this subject is still too difficult (Ziessman et al., 2004). Radionuclide transit/emptying scintigraphy provides a means of characterizing exquisite functional abnormalities with a set of low-cost procedures that are easy to perform and widely available, entail a low radiation burden, closely reflect the physiology of the tract under evaluation, are well tolerated and require minimum cooperation by patients, and provide quantitative data for better inter subject comparison and for monitoring response to therapy. Despite the relatively low degree of standardization both in the scintigraphic technique per se and in image processing, these methods have excellent diagnostic performance in several function or motility disorders of the upper digestive tract. Dynamic scintigraphy with a radioactive liquid provides excellent information on gastric emptying (Mariani et al., 2004). Recently, ¹³C-acetate breath test and magnetic resonance imaging (MRI) techniques have also been developed to measure gastric emptying and to monitor gastric emptying and motility simultaneously, but scintigraphy is still accepted as a gold standard technique for measurement of gastric emptying (Feinle et al., 1999;Braden et al.,1995).

Few investigations have objectively assessed the effect of a variety of surgical procedures on gastric emptying and gastrointestinal motility (Koksoy et al. 1994;Ibrarullah et al.,1994;Rhind and Watson, 1968). However, several reports based on detailed inquiries have determined the prevalence of dyspepsia before and after surgery (Rhind and Watson, 1968; Bates et al., 1984;Kingston and Windsor, 1975). Recently, Vignolo et al. have also reported the late period effects of laparoscopic cholecystectomy on rate of gastric emptying in a new study. In addition, they have also shown that laparoscopic cholecystectomy does not interfere with the gastric emptying time of solids or semisolids in dyspeptic individuals with cholecystolithiasis (Vignolo et al., 2008). Koksoy et al. demonstrated that dyspepsia, in cholelithiasis and persisting after cholecystectomy, had a

close relation with delay in gastric emptying, and Stavrakia et al. have also found that there was a delay in gastric emptying time and this finding was related to symptoms after gastrointestinal/biliary surgery (Koksoy et al. 1994; Stravka et al., 2002). Similarly, Wilson et al. have also shown that the persistence symptoms were associated with pathologic duodenogastric reflux after cholecystectomy (Wilson et al., 1995). Hotekezeka et al. have also reported that gastric emptying in the open cholecystectomy group was significantly delayed on postoperative day 1 compared with pre-operative emptying but was not delayed on postoperative day 2 and that gastric emptying in the laparoscopic group was not delayed after operation. In the same study, it was found that transit time was the same between groups but gastric dysrhythmias were more frequent on postoperative day 3 in the open group (Hotekezeka et al., 1997).

In our study, we also found that the total gastric emptying time in patients undergoing laparoscopic cholecystectomy was significantly longer than in the Control group (p<0.05). The aggravated hypoxia is followed by increased inflammatory cytokines, reactive oxygen species and inflammatory response thereby increasing the tissue injury. Gastrointestinal dysfunction due to intra-abdominal pressure may be responsible for the increase in the gastric emptying time.

In summary, laparoscopic surgical operations can affect the gastric emptying time although they can be accepted as minimal invasive procedures. A few days of minimal discomfort, disorder, dyspepsia and early satiety, nausea and/or vomiting and flatulence may be associated with a delay in gastric emptying which is due to intra-abdominal pressure after laparoscopic surgical procedures. Further studies are needed in this subject.

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