ORIGINAL ARTICLE − OPEN ACCESS

Effects of Ramadan Fasting on Gastrointestinal System

Umut Payza[1] , Ahmet Kayalı[1] , Zeynep Karakaya[1] , Fatih Esat Topal[1] , Serkan Bilgin[1] , Firdevs Topal[2] , Pınar Yeşim Akyol[1] , Umur Suadiye[1]

ABSTRACT

Objective: The aim of this study was to investigate the effects of Ramadan model intermittent fasting (IF) on acute pancreatitis, acute cholecystitis, and acute cholangitis, which is closely related to nutrition.

Materials and Methods: This retrospective research study was conducted from 2014 to 2018. Patients over 18 years old with acute pancreatitis, acute cholecystitis, and acute cholangitis were included in the study. Patients with lipid metabolism disorders such as hyperlipidemia, pregnant women, malignancies, viral infections, hepatic insufficiency, and cirrhosis were excluded from the study. A total of 3940 patients were included in the study. Hospital applications in Ramadan were compared with the rest of the year.

Results: One thousand eight hundred and sixteen male and 2124 female patients were included in the study. 1797 patients (45.6%) with pancreatitis, 1032 patients (26.2%) with cholangitis and 1015 patients (25.8%) with cholecystitis. Pancreatitis (46.4%), cholangitis (29.8%), and cholecystitis (19.3%) were the most frequently diagnosis in Ramadan. The monthly admission rates were calculated in a 5-year period. It was found that the admission rates were 26.6% more in Ramadan than other months. Ramadan fasting significantly increased acute pancreatitis and acute cholangitis. However, cholecystitis decreased. Both sexes were similarly affected from the Ramadan period.

Conclusion: Ramadan model of IF induces an increase in the incidence of acute pancreatitis and acute cholangitis and a decrease in acute cholecystitis. Ramadan model may not be a suitable model for a healthy diet.

Keywords: Gastrointestinal disease, intermittent fasting, ramadan

¹Department of Emergency Medicine, Atatürk Training and Research Hospital, Katip Çelebi University, İzmir, Turkey
²Department of Gastroenterology, Atatürk Training and Research Hospital, Katip Çelebi University, İzmir, Turkey

Correspondence
Umut Payza,
Katip Çelebi University,
Atatürk Training and Research Hospital, Department of Emergency Medicine,
İzmir, Turkey
Phone: +90 232 243 43 43
e-mail:
umutpayza@hotmail.com

INTRODUCTION

According to the data of 2017, there are 1.8 billion Muslims, constituting 24.1% of the world's population (1). The 9th month of the Hijri calendar is Ramadan. Ramadan is a holy month when Muslims fast, and it lasts 29 or 30 days. Every year it moves forward by 10 days. Fasting in the month of Ramadan is one of the five pillars of Islam. During Ramadan, believers take no food or drink for a fixed period each day, that is, from dawn till sunset, and they eat and drink during the night. This continues throughout Ramadan.

There are numerous publications and recommendations on intermittent fasting (IF) and intermittent calorie restriction. There is a high interest in the scientific community, society, and media for IF and similar diet patterns. IF is a term used for fasting for a while and administering various diets between changing times of fasting periods. The effects of IF on weight loss have been popular in recent years. There are different types of IF. For example, in 2013, Mosley and Spencer (2) published a best-selling book titled "The Fast Diet," which touts the benefits of restricting energy intake severely for 2 days/week but eating normally during the rest of the week. Today, animal experiments and studies with a limited number of volunteer subjects are still continuing. There are contrasting opinions for the benefits of IF on losing weight and metabolism. However, it is still unclear as to which intermittent diet model is healthier.

Acute pancreatitis, cholangitis, and cholecystitis are inflammatory diseases. Their severity can change from mild to life threating. Although the most common causes are gallstones and alcohol consumption, eating habits also play an important role. IF is a topic on which studies are still ongoing. Results for periods of uninterrupted fasting and eating periods are confusing. We evaluated whether IF, fasting from sunrise to sunset and eating during the night without a calorie restriction, was a useful model for pancreatitis, cholangitis, and cholecystitis, which are relatively associated with eating habits.

MATERIALS and METHODS

Study Design

This study was performed in İzmir, where Muslims constitute 98% of the population. Patients admitted with acute pancreatitis, acute cholangitis, and acute cholangitis were evaluated. These data were compared with the admissions during Ramadan, which creates a major change in the nutrition period. A 5-year period was retrospectively evaluated. The data were analyzed and the effects of IF on health were tried to be predicted.

This study was approved by the ethics committee of İzmir Katip Çelebi University and ethic committee approval issue number and date was 192/April 25, 2019.

Patients and Setting

The study was conducted in İzmir Katip Çelebi University, Atatürk Training and Research Hospital between 2014 and 2018. The hospital has the largest gastroenterology unit in the Aegean region. There are 50 beds in the unit and there are 65,000 admissions per year.

Patients aged over 18 years were included in the study. Patients diagnosed as having acute pancreatitis, acute cholangitis, and acute cholangitis in the emergency room were scanned. These patients were evaluated by a gastroenterologist and were hospitalized. Demographic characteristics, diagnosis, and the date at which they received the diagnosis were recorded. Pregnant women and patients with malignancies, viral infections, hepatic failure, cirrhosis, and lipid metabolism disorders such as hyperlipidemia were excluded from the study. Patients with missing data were excluded from the study. Repeated admissions were not included in the study.

Definition of Disease

The diagnosis of acute pancreatitis, acute cholecystitis, and acute cholangitis was determined by a physician with detailed examination and laboratory results. Abdominal ultrasonography (USG) was performed in all patients included in the study. Computed tomography (CT) was used for patients whose diagnosis could not be confirmed using USG. USG and CT were interpreted by radiologists. All patients were consulted by gastroenterologists and were hospitalized. In this way, the diagnosis was confirmed by gastroenterologists after clinical compliance, laboratory analysis, USG, and tomography were analyzed.

Data Collection

The patients were scanned in the database between 2014 and 2018. Data were recorded between January and December each year. The months of Ramadan were identified for each year. All admissions were recorded. The demographic characteristics and diagnoses of the patients who met the inclusion criteria were determined. Patients who were admitted during the year and in the month of Ramadan were noted.

Statistical Analysis

Data were analyzed using the IBM SPSS Statistics 25.0 package program (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.). Descriptive statistics are given as number (n) and percent (%). The relationship between categorical variables was analyzed using Pearson's exact Chi-square test in r X c tables and $p < 0.05$ was considered statistically significant.
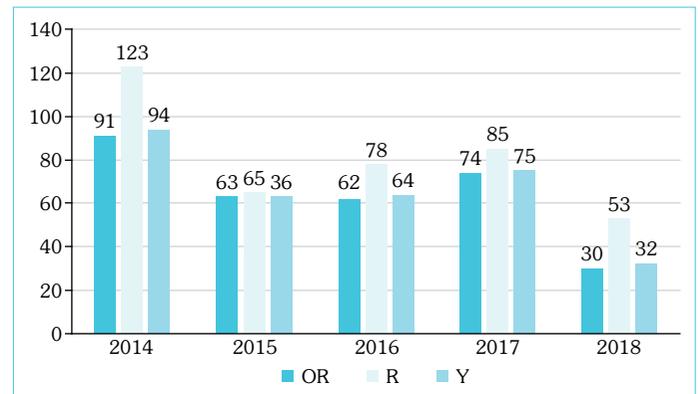

Figure 1. The number of cholecystitis, pancreatitis, cholangitis admissions during the month of Ramadan, average other months of year and the average admission per years

OR: Months other than Ramadan; R: Ramadan; Y: Average all admissions of year

RESULTS

Of the 6923 patients diagnosed in the emergency room, 3940 patients who met the inclusion criteria were included in the study. Of the patients, 1816 were male and 2124 were female. The distribution of diseases was as follows: 1797 patients (45.6%) with pancreatitis, 1032 patients (26.2%) with cholangitis, and 1015 patients (25.8%) with cholecystitis. The most frequently encountered disease was pancreatitis (46.4%) and the others were cholangitis (29.8%) and cholecystitis (19.3%) in Ramadan. Gastroenterology clinic reports were used for the diagnosis of the patients included in the study. When these reports were evaluated, 85% (n=1527) of pancreatitis were caused by choledocholithiasis. About 11% (n=198) were chronic alcohol addiction and 4% (n=72) were primary infections. About 97% (n=1985) were reported as bile duct stones and 3% (n=62) as primary infection of 2047 patients diagnosed with cholangitis and cholecystitis. There was a statistically significant difference between the Ramadan period and the other months in terms of the distribution of diagnoses (Fig. 1). The frequency of pancreatitis and cholangitis was higher and the frequency of cholecystitis was lower in Ramadan than in other months (Table 1).

Both males and females were similarly affected in terms of diagnoses in Ramadan. However, cholangitis and pancreatitis were more common in females than in males. There was no difference between the sexes in terms of decreasing cholecystitis (Table 2). The mean age of the males was 62±16.2 years. The most frequently encountered diagnosis was, alone or together with others, pancreatitis (44.9%), and the others were cholangitis (28.1%) and cholecystitis (26.1%) in males in Ramadan. There was a statistically significant difference between the Ramadan and outside of Ramadan periods in terms of diagnoses in males (p<0.011). The frequency of pancreatitis and cholangitis significantly increased and cholecystitis decreased in Ramadan than in other months in males (p<0.05). The mean age of the females was 60±18.8 years. There was a statistically significant difference between the Ramadan and outside of Ramadan periods in terms of diagnoses in females, similar to males (p<0.002). The most frequently encountered diagnosis was pancreatitis and the others were cholangitis and cholecystitis in females, as in males

Table 1. The distribution of diagnoses in the Ramadan period and in the rest of the year

Diagnosis	Ramadan		Other months		Total		p*
	n	%	n	%	n	%	
Cholecystitis	77[a]	19.3	938[b]	26.5	1015	25.8	
Pancreatitis	185[a]	46.4	1612[a]	45.5	1797	45.6	<0.001
Cholangitis	119[a]	29.8	9138[a]	25.8	1032	26.2	

*: Pearson Chi-square. The superscripts a, b show the difference between groups. Groups with the same letters are similar

Table 2. The distribution of sexes according to the diagnoses (n=3940)

Diagnosis	Male		Female		Total		p*
	n	%	n	%	n	%	
Cholecystitis	474	26.1	541	25.5	1015	25.8	0.652
Pancreatitis	788	43.4	1009	47.5	1797	45.6	0.010
Cholangitis	510	28.1	522	24.6	1032	26.2	0.013

*: Pearson Chi-square

in Ramadan. The frequency of cholecystitis decreased in Ramadan than in other months in females as in males.

The 5-year period compared within itself. There was no correlation between the months, seasons, or the years (p>0.05) (Fig. 2).

DISCUSSION

Obesity causes serious health problems as heart failure, disrupts insulin metabolism, hypertension, and cardiovascular diseases (3, 4). The obesity rate in the United States is 30–35%. The cost to the health system is estimated as 147 billion dollars per year (5, 6). The obesity rates were reported as 34% in males and 21.7% in females in Turkey in 2016. These rates were higher than the worldwide obesity rates (11% in males and 15% in females) (7).

To prevent obesity, there are different methods such as reducing food intake, exercise, liposuction, and surgical methods. IF is one of these methods. Simply put, it is known as intermittent nutrition and energy restriction. When one examines, many scientific publications evidence and experience to show that IF has benefits can be found. For example, Mosley and Spencer (2) stated in their best-selling book that calorie restriction on 2 days per week has positive consequences.

Ethnology and many religious books write a remarkable variety of forms and practices of fasting (8). These practices are believed to strengthen health and religious beliefs. IF is one of them and a quarter of the world's population is making IF because of their religious beliefs, in the month of Ramadan. In this model, people are completely starved between sunrise and sunset, and there is no liquid intake, including water.

IF is one of the essentials of Islam. Healthy adult Muslims fast from dawn to sunset during the holy month. In addition, liquid intake, smoking, and drugs are prohibited. Depending on the season and geographic location, the daily fast varies from 11 to 22 h. Muslims
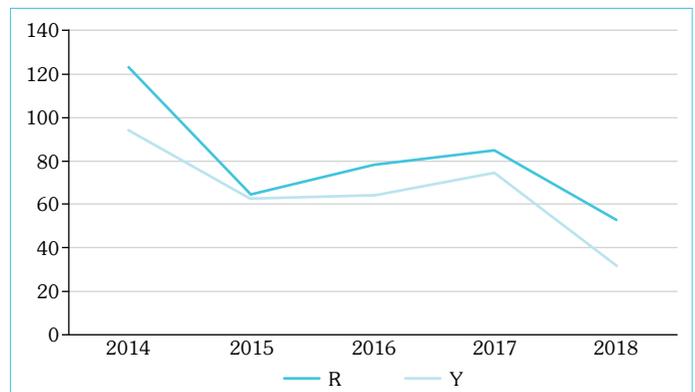
Figure 2. Number of total and Ramadan month admissions during period

R: Ramadan; Y: Average all admissions of year

in Turkey adhere to the fasting period during Ramadan. Therefore, the entire population is affected. Drozdinsky et al. (9) reported that the periods of fasting in Muslim societies affect almost all of society. This is a strong assumption.

In the present study, a large number of patients were included to allow reliable conclusions to be drawn, both males and females were well represented. There was no statistically significant difference between the mean age of males and females. We clearly observed that the admissions were higher in the Ramadan period of the year. We saw that acute pancreatitis and acute cholangitis increased among both sexes during Ramadan month. On the contrary, we observed that cholecystitis decreased in both sexes. When the entire 5-year period was examined, it was seen that both sexes were affected in a similar way from the IF. The increase was evident in both males and females. However, there was a statistically significant difference when the distribution of the diagnoses was examined according to the sex of the patients. Cholangitis and pancreatitis were significantly higher in females. However, there

was no difference between the two sexes in terms of the decrease in the rate of cholecystitis. Our results concur with the findings of Drozdinsky et al. (9) that the rate of acute pancreatitis rose during the period of Ramadan. It was stated that there was a statistically significant difference between those did and did not fast during Ramadan. However, they did not show any difference between females and males (9). It was also reported that the rate of acute pancreatitis and cholangitis increases in patients with eating disorders (10). Isolated case reports suggested that gastric dilatation maybe caused by food intake is the causative agent in nutritional-related diseases (11). In addition, it is stated that the contraction of the gallbladder during prolonged periods of hunger causes formation of stasis. It is also reported that the stasis increases the inflammation in gallbladder and the formation of stones (12).

A study by Munhoz and Carpinelli (13) in rats found that IF decreased body weight, but increased fat tissue and decreased muscle tissue. After IF, an increase in both basal insulin values in plasma concentrations was detected after giving glucose. In addition, degradation in phosphorylation in peripheral tissue and insulin resistance was indicated. In the same study, it was emphasized that although IF caused weight loss, it had unwanted effects on tissue homeostasis. Therefore, it was shown that glucose tolerance and lipid metabolism deteriorated (13). Two recent studies (14, 15) reported that the metabolic response was faster during the day and its rate decreased at night. Food intake in the day instead at night had a negative effect on glucose and lipid metabolism by affecting the circadian cycle. In addition, it was shown that bacterial flora of the gastrointestinal tract of patients with obesity triggered intra-abdominal infections by allowing inflammation (14, 15). Patterson and Sears offered evidence to supporting this. In their review, they stated that Ramadan model was the most common form of time-restricted diet and provided temporary weight loss, but there was mixed evidence for improvements in metabolic markers. However, it is stated that this dietary pattern is biologically opposed to the human circadian rhythm (16). Manoogian and Panda (17) concluded that if the circadian cycle was disrupted, the results would be negative. Sadeghirad et al. (18) suggested that the eating period at nights during Ramadan, the lack of calorie restriction during eating, and the consumption of foods containing fat caused negative effects on lipid and glucose metabolism.

It is possible to come across many publications that show that the Ramadan model has beneficial effects in terms of weight loss. Harder-Lauridsen et al. (19) showed that IF had positive effects on body composition, glucose metabolisms, and cognitive functions. Saleh et al. (20) supported these positive results. However, in another study of Patterson et al. (21), Ramadan model was not reported as a suitable model for circadian metabolism. Ajabnoor et al. (22) indicated that IF could change circadian rhythm and could even increase cardiovascular risk. Bahammam (23) indicates that IF could disrupt circadian rhythm and sleep patterns and could cause low-energy performance. Bahijri et al. (24) revealed that the practice of Ramadan would cause hypercortisolism in the evening and showed its relationship with increased insulin resistance.

We observed that there was a higher prevalence of the bile system pathologies during the Ramadan era relative to other times. One of the reasons for this is binge eating after a long time of fasting. Binge eating induces a rapid enlargement of the stomach. Pancreas and gallbladder function more and rapidly (25). Biliary tract compressed by the stomach and increased intraduodenal pressure can result in bile reflux and cause cholangitis and pancreatitis (26). In addition, the stretched stomach induces high cholecystokinin release and cholecystokinin activates the pancreas and biliary system (27). Fatty diet also affects the bile system. High-calorie foods, eaten from sunset to sunrise, disrupt the balance of cholesterol and triglyceride (28). Another big consideration is avoiding the consumption of fluids. Limiting the fluid causes dehydration. Increased plasma osmolarity and hyperviscosity slow the flow of bile (28, 29). We estimate that pancreatitis and cholangitis increased because of these irregularities.

Evidence of the effects of IF in humans is usually based on observational data, especially in Ramadan. Many studies have modest sample sizes or they are experimental studies. Our study included 3940 patients and we believe that this number will provide a high level of reliability compared with other studies. In addition, we believe that the exclusion of patients with lipid metabolism disorder in our study shows the effects of IF on nutrition more clearly.

Limitations
We found that the frequency of cholangitis and pancreatitis increased and we supported this result with similar studies and case reports. However, on the contrary, we found that the frequency of cholecystitis declined. There are no studies explaining the reduction of cholecystitis in Ramadan model. Lipid profiles and weight follow-ups were not recorded in the month of Ramadan. In addition to this, the prohibition of liquid intake during IF can be effective in the increase of gastrointestinal diseases.

CONCLUSION

The present study indicates that the Ramadan IF model is not a healthy diet. Fasting during the daytime without fluid intake and erratic feeding from sunset to dawn may lead to adverse effect.

REFERENCES

1. The Changing Global Religious Landscape. Available from: http://www.pewforum.org. Accessed April 05, 2017.
2. Mosley M, Spencer M. The FastDiet: Lose Weight, Stay Healthy, and Live Longer with the Simple Secret of Intermittent Fasting. New York: Atria; 2013.
3. Khan SS, Ning H, Wilkins JT, Allen N, Carnethon M, Berry JD, et al. Association of body mass index with lifetime risk of cardiovascular disease and compression of morbidity. JAMA Cardiol 2018; 3(4): 280−7.

4. Lavie CJ, De Schutter A, Parto P, Jahangir E, Kokkinos P, Ortega FB, et al. Obesity and prevalence of cardiovascular diseases and prognosis-the obesity paradox updated. Prog Cardiovasc Dis 2016; 58(5): 537–47. [CrossRef]

5. Chaix A, Zarrinpar A. The effects of time-restricted feeding on lipid metabolism and adiposity. Adipocyte 2015; 4(4): 319–24. [CrossRef]

6. Iliodromiti S, Celis-Morales CA, Lyall DM, Anderson J, Gray SR, Mackay DF, et al. The impact of confounding on the associations of different adiposity measures with the incidence of cardiovascular disease: A cohort study of 296 535 adults of white European descent. Eur Heart J 2018; 39(17): 1514–20. [CrossRef]

7. World Health Organization. Obesity: Preventing and Managing the Global Epidemic. Vol. 894. Report of a WHO Consultation, WHO Technical Report Series. Geneva: World Health Organization; 2018. p. 252. http://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en. Accessed March 8, 2018.

8. Timmis A, Townsend N, Gale C, Grobbee R, Maniadakis N, Flather M, et al. European Society of Cardiology: Cardiovascular disease statistics 2017. Eur Heart J 2018; 39(7): 508–79. [CrossRef]

9. Drozdinsky G, Agabaria A, Zuker-Herman R, J Drescher M, Bleetman T, Shiber S. High rate of acute pancreatitis during the Ramadan fast. Eur J Gastroenterol Hepatol 2018; 30(6): 608–11. [CrossRef]

10. Kim HH, Park SJ, Park MI, Moon W. Acute gastric dilatation and acute pancreatitis in a patient with an eating disorder: Solving a chicken and egg situation. Intern Med 2011; 50(6): 571–5. [CrossRef]

11. Santos T, Freitas C, Pinto-de-Sousa J. Gastric wall ischemia following massive gastric distension due to peptic pyloric stenosis: A case report. J Surg Case Rep 2016; 2016(2): rjw008. [CrossRef]

12. Working Group IAP/APA Acute Pancreatitis Guidelines. IAP/APA evidence-based guidelines for the management of acute pancreatitis. Pancreatology 2013; 13(4 Suppl 2): e1–15. [CrossRef]

13. Munhoz C, Carpinelli A. Intermittent fasting for three months decreases pancreatic islet mass and increases insulin resistance in Wistar rats. Endocr Abstracts 2018; 56: 519.

14. Ridaura VK, Faith JJ, Rey FE, Duncan AE, Kau AL, Griffin NW, et al. Gut microbiota from twins discordant for obesity modulate metabolism in mice. Science 2013; 341(6150): 1241214. [CrossRef]

15. Shen J, Obin MS, Zhao L. The gut microbiota, obesity and insulin resistance. Mol Aspects Med 2013; 34(1): 39–58. [CrossRef]

16. Patterson RE, Sears DD. Metabolic effects of intermittent fasting. Annu Rev Nutr 2017; 37: 371–93. [CrossRef]

17. Manoogian EN, Panda S. Circadian rhythms, time-restricted feeding, and healthy aging. Ageing Res Rev 2017; 39: 59–67. [CrossRef]

18. Sadeghirad B, Motaghipisheh S, Kolahdooz F, Zahedi MJ, Haghdoost AA. Islamic fasting and weight loss: A systematic review and meta-analysis. Public Health Nutr 2014; 17(2): 396–406. [CrossRef]

19. Harder-Lauridsen NM, Rosenberg A, Benatti FB, Damm JA, Thomsen C, Mortensen EL, et al. Ramadan model of intermittent fasting for 28 d had no major effect on body composition, glucose metabolism, or cognitive functions in healthy lean men. Nutrition 2017; 37: 92–103. [CrossRef]

20. Saleh SA, Elsharouni SA, Cherian B, Mouroux M. Effects of Ramadan fasting on waist circumference, blood pressure, lipid profile, and blood sugar on a sample of healthy Kuwaiti men and women. Mal J Nutr 2005; 11(2): 143–50.

21. Patterson RE, Laughlin GA, LaCroix AZ, Patterson RE, Laughlin GA, LaCroix AZ, et al. Intermittent fasting and human metabolic health. J Acad Nutr Diet 2015; 115(8): 1203–12. [CrossRef]

22. Ajabnoor GM, Bahijri S, Borai A, Abdulkhaliq AA, Al-Aama JY, Chrousos GP. Health impact of fasting in Saudi Arabia during Ramadan: Association with disturbed circadian rhythm and metabolic and sleeping patterns. PLoS One 2014; 9(5): e96500. [CrossRef]

23. Bahammam A. Does Ramadan fasting affect sleep? Int J Clin Pract 2006; 60(12): 1631–7. [CrossRef]

24. Bahijri S, Borai A, Ajabnoor G, Abdul Khaliq A, AlQassas I, Al-Shehri D, et al. Relative metabolic stability, but disrupted circadian cortisol secretion during the fasting month of Ramadan. PLoS One 2013; 8(4): e60917. [CrossRef]

25. Benson JR, Ward MP. Massive gastric dilatation and acute pancreatitis--a case of "Ramadan syndrome"? Postgrad Med J 1992; 68(802): 689. [CrossRef]

26. Wu BU, Johannes RS, Sun X, Tabak Y, Conwell DL, Banks PA. The early prediction of mortality in acute pancreatitis: A large population-based study. Gut 2008; 57(12): 1698. [CrossRef]

27. Nordback CC, Clemens JA, Cameron JL. Role of cholecystokinin in pathogenesis of acute pancreatitis in isolated pancreas preparation. Surgery 1991; 109(3 Pt 1): 301–6.

28. Drozdinskyb G, Agabariaa A, Zuker-Hermana R, Dreschera MJ, Bleetmana T, Shibera S. high rate of acute pancreatitis during the Ramadan fast. Eur J Gastroenterol Hepatol 2018; 30(6): 608–11. [CrossRef]

29. Luckey AE, Parsa CJ. Fluid and electrolytes in the aged. Arch Surg 2003; 138(10): 1055–60. [CrossRef]