

# Management of perforated peptic ulcer in patients at a teaching hospital

Ali K. Bin-Taleb, MS, PhD, Riyadh A. Razzaq, MD, PhD, Zaki O. Al-Kathiri, MBBS, MS.

## ABSTRACT

**الأهداف:** استكشاف وتحليل الوضع الحالي في معالجة المرضى بالقرح الهضمية المثقوبة.

**الطريقة:** الدراسة أجريت في القسم الجراحي لمستشفى الجمهورية التعليمي، عدن / اليمن. جرى تحليل و تقييم رجعي لثقوب القرح الهضمية من ملفات المرضى اللذين أدخلوا في الفترة الزمنية من يناير / 1997 حتى ديسمبر / 2006.

**النتائج:** مائة ستة وخمسون مريضاً سُجّلوا في الدراسة؛ الرجال كانوا (138) ونساء (18)، بنسبة الرجال إلى النساء (1:7.67). العمر المتوسط كان 39.1 سنة (تراوح من 14 إلى 75 سنة) بينما أكثر الحالات بثقوب القرح الهضمية وجدت عند مرضى المجموعة العمرية 21-40 سنوات (58.3%). نسبة ثقوب قرحة الإثني عشر إلى ثقوب القرحة المعدية كانت (1:4.38). معظم المرضى طُوروا إلى المستشفى كآفة من 16.5 ساعة من حادثة الثقوب، أما متوسط زمن التدخل الجراحي بعد الدخول كان 5.25 ساعة. معظم المرضى (91.7%) أجريت لهم عمليات إغلاق الثقوب البسيط. التعقيدات ما بعد الجراحة ظهرت عند 41% من المرضى (هامة إحصائياً في الحالات التي أدخلت بعد أكثر من 12 ساعة من حدوث الثقوب) غالبية المضاعفات (55.2%) كانت بشكل عدوى جروح العمليات؛ توفي 6 من المرضى (3.9%) ارتباطاً وقت الدخول بالوفيات إحصائياً لم يكن هاماً. المتوسط العام لفترة الإقامة بالمستشفى ما بعد التدخل الجراحي كان 12.76 يوماً؛ 14.7% من المرضى بقي أكثر من 3 أسابيع، وحتى إلى 34 يوماً.

**خاتمة:** المرضى الأصغر (40-21 سنوات) هم الأكثر عرضة لثقوب القرحة الهضمية. نؤكد على أهمية اختصار الوقت إلى الجراحة. يبقى الإغلاق البسيط المعالجة المختارة في أغلبية المرضى. معدل الوفيات ما بعد الجراحة عموماً كان منخفضاً (3.9%). من المهم جداً تحسين المهارات الجراحية، عناية الجروح، القوانين الإدارية، بيئة المستشفى، و المعدات والتجهيزات - ذلك من أجل خفض نسبة المضاعفات العالية ما بعد التدخل الجراحي.

**Objectives:** To explore and analyze the current status in management of patients with perforated peptic ulcers (PPU).

**Methods:** A retrospective study carried out at the Surgical Department, Al-Gamhouria Teaching Hospital, Aden, Yemen. Patients admitted with perforated benign peptic ulcers from January 1997 to December 2006 were included in the study.

**Results:** A total of 156 patients, 138 (88.5%) male and 18 (11.5%) female, with an overall mean age of 39.08 years (range 14-75 years) and a higher frequency of PPU was noted in patients 21-40 years (58.3%). The perforated duodenal ulcer and perforated gastric ulcer ratio was 4.38:1. The mean time of presentation was 16.5 hours, and operative intervention after admission was 5.25 hours. Simple perforation closure was used in 91.7% of the patients. Postoperative complication rate was 41% (statistically significant in cases admitted later than 12 hours), wound sepsis making the majority at 55.2%, 6 deaths (3.9%), the correlation with presentation time was not significant. The overall mean post-operative hospitalization period was 12.76 days; 14.7% of the patients stayed more than 3 weeks.

**Conclusions:** Younger patients (21-40 years) were frequently affected. Emphasis should be placed on shortening the time to surgery. Simple closure remains the selected treatment in the majority of patients. Overall post-operative mortality was low (3.9%). Improving the surgical skills, wound care, administrative regulations, hospital environment, and equipment are needed to reduce the high rate of complications.

*Saudi Med J 2008; Vol. 29 (2): 245-250*

*From the Department of Surgery, Faculty of Medicine and Health Sciences, University of Aden, Aden, Yemen.*

*Received 26th August 2007. Accepted 11th December 2007.*

*Address correspondence and reprint request to: Dr. Riyadh A. Razzaq, Associate Professor of General Surgery, Faculty of Medicine and Health Sciences, University of Aden, PO Box 4542, Crater, Aden, Republic of Yemen. Tel. +967 733590131. Fax +967 (2) 250696. E-mail: riadh@yemen.net.ye*

Despite modern medications for peptic ulcers (PU), leading to a decreased incidence of elective surgery,<sup>1,2</sup> complications of PU have remained fairly constant or increased,<sup>1,3</sup> and PU perforation remains a source of mortality.<sup>3-5</sup> The rate of complications and mortality has not declined during recent decades, the mortality rate for perforated peptic ulcers (PPU) can be as high as 23-30%,<sup>1,6,7</sup> particularly if the patient population has a large proportion of elderly,<sup>8</sup> where the morbidity is reported as 25-89%.<sup>9,10</sup> Recently, PPU is a problem seen in the elderly, especially in women,<sup>2,11</sup> possibly due to the increased use of non-steroidal anti-inflammatory drugs (NSAIDs).<sup>9,11,12</sup> Due to the recognition of *Helicobacter pylori* (*H. pylori*) as a causative agent in the duodenal ulcer disease, and the introduction of H<sub>2</sub> blockers and proton pump inhibitors as an effective medical treatment after surgery, the need for definitive ulcer surgery in the acute management of perforated duodenal ulcers (PDU) is questioned,<sup>13</sup> and simple closure followed by eradication therapy of *H. pylori*<sup>14-16</sup> has become the preferred option for many surgeons.<sup>11</sup> There are encouraging reports of non-operative treatment for PPU in selected patients with associated medical diseases.<sup>17-19</sup> Since the early 1990s, the laparoscopic technique has been increasingly used for the treatment of PPU.<sup>13,20-23</sup> The objective of this retrospective study was to provide data related to patients with PPU treated in a teaching hospital in Aden, Yemen.

**Methods.** Al-Gamhouria University Hospital is one of the 2 main teaching hospitals in Aden City of Yemen Republic, treating 26000-28000 patients per year, of which 55% are surgical patients and 29-31% are admitted cases. A retrospective study of 156 hospitalized patients (>14 years old) for PPU in the Surgical Department admitted as surgical emergencies during the 10-year period from January 1997-December 2006 were carried out. After ethical approval was obtained, records of the patients were reviewed and abstracted using a standardized data collection form. Patients with perforated malignant tumors were excluded. The records were analyzed for the following: age, gender, smoking status, use of NSAID, blood group, co-morbidity, socio-economic level, duration of symptoms (including before admission, up to the operation after admission), radiological findings (plain abdominal x-ray for free air under diaphragm), site of perforation (duodenal, gastric I - body and lesser curvature, II - duodenal + pre-pyloric areas, III - pre-pyloric and antral, IV - high in the proximal stomach or cardia), method of operative repair, postoperative complications and case fatality ratio, and duration of hospitalization (pre- and post-operative). The computer program Quickcalcs of Graphpad software (<http://graphpad.com/quickcalcs>)

was used for data analysis. Student's t-test, chi-square, and the Fisher's exact test were employed; a 2-tailed *p*-value of less than 0.05 was considered significant.

**Results.** A total of 156 patients (**Table 1**) were enrolled in this study with a mean age of 39.08 years (range: 14-75 years [median: 37 years]; SD±13.6; 95% confidence interval [CI]: 36.93-41.23 years). There were 138 (88.5%) males (mean age 38.17 years, range: 14-75 years [median: 36 years]; SD±13.42; 95% CI: 35.91-40.43 years), and 18 (11.5%) females (mean 46.11 years, range: 22-65 years [median: 48 years]; SD±13.15; 95% CI: 39.57-52.65 years) (*p*=0.0081); the male to female ratio was 7.67:1). Distribution of patients by age groups revealed higher frequency of PPU in patients of age group 21-40 years (91 cases, 58.3%); however, mainly present in younger men (65.9%) of less than 40 years of age, and women (77.8%) of more than 40 years. All of the 156 patients were admitted as emergency cases, 127 (81.4%) with PDU, and 29 (18.6%) with perforated gastric ulcer (PGU), with PDU/PGU ratio of 4.38:1. Fifty-nine (37.8%) had no history of acid peptic disease; 104 (66.7%) had history of tobacco consumption, of which 2 (11.1%) were women and 102 (73.9%) were men; 29 (18.6%) were chronic NSAIDs users, and 46 (29.5%) had a co-morbid condition (ischemic heart disease, arterial hypertension, diabetes mellitus, and chronic obstructive pulmonary disease). Free air under the diaphragm was seen in 139 patients (89.1%). The most frequent blood group encountered was type "O" (62%), type "A" (28%), and 5% each for types "B" and "AB". A higher percentage of patients (59.6%) belonged to the lower socio-economic level group. The mean time of presentation since the onset of perforation was 16.5 hours, ranging from 1.25-54.5 hours. Only 33 patients (21.2%) attended the hospital within the first 6 hours of perforation incidence, whereas 19 (12.2%) of them came later than 24 hours. In the majority of the cases, (61, 39.1%), the presentation time was between 12 and 18 hours. The mean time of operative intervention after admission was 5.25 hours, ranging from 3.25-18.5. In the majority of the patients (99, 63.5%), the operation was performed between 6 and 12 hours of admission to the surgical department. The overall perforation time (from the onset of perforation up to the time of surgery) ranged between 3.75 and 60.5 hours, with a mean of 25.5 hours (**Table 2**). Eight patients (27.6%) out of 29 with PGU had type I gastric ulcer, whereas 21 (72.4%) had type III. In most of the patients with PPU (91.7%), simple perforation closure with Graham's patch omentoplasty was carried out. **Table 3** illustrates the type of operations performed in PDU; in most of the patients (118, 92.9%), simple closure with omentoplasty was used, while closure of perforation with truncal vagotomy plus gastro-jejunostomy in 5

**Table 1 -** Distribution of patients by age groups, gender, and sites of perforation.

Site of perforation	Age groups (years) and gender								Total (n=156)	
	≤ 20 (n=4)		21 - 40 (n=91)		41 - 60 (n=40)		≥ 60 (n=21)		M	F
	M	F	M	F	M	F	M	F		
	n (%)		n (%)		n (%)		n (%)		n (%)	
Perforated DU n=127 (81.4%)	4 (3.1)	--	71 (55.9)	3 (2.4)	29 (22.8)	4 (3.2)	11 (8.7)	5 (3.9)	115 (90.6)	12 (9.5)
Perforated GU n=29 (18.6%)	--	--	16 (55.2)	1 (3.4)	4 (13.8)	3 (10.4)	3 (10.4)	2 (6.9)	23 (79.3)	6 (20.7)
<b>Total</b> n=156 (100%)	4 (2.6)	--	87 (55.8)	4 (2.6)	33 (21.1)	7 (4.5)	14 (9.0)	7 (4.5)	138 (88.5)	18 (11.5)

M - male, F - female, DU - duodenal ulcer, GU - gastric ulcer

**Table 2 -** Distribution of patients according to presentation time since perforation, and the outcome.

Presentation time	Patients n (%)	Morbidity n (%)	Mortality n (%)
≤ 6 Hours	33 (21.2)	2 (6.1)	--
7-12	14 (9.0)	3 (21.4)	--
13-18	61 (39.1)	23 (37.7)	2 (3.3)
19-24	29 (18.6)	17 (58.6)	1 (3.5)
>24 hours	19 (12.2)	19 (100)	3 (15.8)
<b>Total</b>	<b>156 (100)</b>	<b>64 (41.03)</b>	<b>6 (3.9)</b>

**Table 3 -** Distribution of patients by age groups, gender, and sites of perforation.

Site of perforated ulcer	Type of operation								Total	
	Simple closure plus omentoplasty with gastric or without duodenal excision		Closure + gastrojejunostomy + truncal vagotomy		Simple closure + pyloroplasty + truncal vagotomy		Antrectomy + truncal vagotomy		n (%)	n (%)
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)				
Duodenal	118*	(92.9)	5*	(3.9)	4*	(3.2)	0	0	127	(81.4)
Gastric	25*	(86.2)	0	0	0	0	4	(13.8)	29	(18.6)
<b>Total</b>	<b>143</b>	<b>(91.7)</b>	<b>5</b>	<b>(3.2)</b>	<b>4</b>	<b>(2.6)</b>	<b>4†</b>	<b>(2.6)</b>	<b>156</b>	<b>(100)</b>

\*with one death, †with 2 deaths

(3.9%), and truncal vagotomy plus pyloroplasty in 4 cases (3.2%) were used. In most patients with PGU, 25 (86.2%) excision of the ulcer with omentoplasty was performed, whereas the rest of the patients (4, 13.8%) underwent antrectomy plus truncal vagotomy. Post-operative complications developed in 64 (41%) patients, wound sepsis making the majority (58, 55.2%) (Table 4). In 37 patients (57.8%) there was only one complication; 13 (20.3%) with 2 complications, and 14 (21.9%) with 3 complications. The statistical analyses for correlation between pre-admission time interval after perforation and the rate of complications by Fisher's exact-test show that the 2-tailed  $p$ -values were of statistically significant difference for those admitted later than 12 hours ( $p=0.0001$ ).

As shown in Table 2, 6 patients (3.9%) died postoperatively (3 with PGU and 3 with PDU), 2 after antrectomy plus truncal vagotomy, one after gastric perforation closure plus omental patch, one after closure of duodenal perforation with gastro-jejunosomy plus truncal vagotomy, one after closure of perforation plus pyloroplasty with truncal vagotomy, and one after duodenal perforation closure plus omental patch. All of the death cases included elderly patients with comorbidity, admitted later than 12 hours after perforation of their ulcers. The causes of death were septicemia in 2 patients, 2 myocardial infarction, one pneumonia with respiratory failure, and one renal failure. Mortality in simple closure group (1.4%, 2/143) was much lower and of statistical significance in comparison to that in the definitively operated group (30.8%, 4/13) ( $p=0.0001$ ). Nevertheless, the 2-tailed  $p$ -values were statistically not significant on the mortality rates in relation to the length of pre-admission perforation time ( $p=0.1290$ ). The overall mean post-operative hospitalization period was 12.76 days; 14.7% (23) of the patients stayed more than 3 weeks, reaching up to 34 days.

**Table 4** - Post-operative complications.

Type of complication	Frequency n (%)
Wound sepsis	58 (55.2)
Paralytic ileus	23 (21.9)
Atelectasis + pneumonia	14 (13.3)
Wound dehiscence (burst abdomen)	3 (2.9)
Deep vein thrombosis	5 (4.8)
External biliary fistula	2 (2.0)
<b>Total</b>	<b>105 (100)</b>

**Discussion.** In our study, the overall mean age of the patients with PPU was 39.08 years (range 14-75 years) and higher frequency of PPU (58.3%) was more frequent in the younger age group (21-40 years), in comparison with other reports.<sup>24,25</sup> This could be related to the earlier age of *H. pylori* infection as reported by Gunaid et al,<sup>26</sup> and the demographic characteristics of the Yemen population.<sup>27</sup> Male preponderance is declining in western countries due to changing pattern of smoking and the increased stress in working women.<sup>28</sup> An absolute increase has been reported in elderly women in different studies.<sup>11,29</sup> The reported percentage of PDU ranges between 78.9%<sup>21</sup> and 94.2%.<sup>24</sup> In our study, the higher percentage of PDU is probably related to *H. pylori* infection.<sup>30,31</sup> Approximately 10-32% of patients usually have no history of PU disease prior to perforations.<sup>32,33</sup> A higher rate in our patients is probably due to unawareness regarding the significance of upper abdominal discomfort. The incidence of NSAIDs use in our patients is lower than the reported studies.<sup>8,11,12,32,33</sup> A study from Turkey reported lower incidence of NSAIDs use (9%).<sup>34</sup> Smoking more than 15 cigarettes a day increases the risk of ulceration and perforation by 3-folds.<sup>28,35,36</sup> Smoking among young people in Yemen is common, which may explain our higher incidence of perforation in young males. Higher frequency of free air under the diaphragm in our patients (89.1%) might be related to the less number of patients attending to the hospital with sealed perforations.

Increased availability of *H. pylori* receptors in the gastro-duodenal mucosa of subjects with blood group "O", as compared with other blood groups,<sup>37</sup> results in greater risk to develop PU and perforation among such populations. The higher percentage of our patients with blood group "O" is in agreement in the Arab and worldwide observations.<sup>38</sup> Risk of post-operative morbidity and mortality is closely related to the duration of perforation.<sup>29,39,40</sup> Although studies from Europe reported a time interval of 10 hours,<sup>8</sup> many surgeons from different countries reported a longer interval.<sup>4,13,24,39</sup> The prolonged interval in our study could be explained by lack of sufficient number of staff in the anesthesia department and operating theater, causing frequent delays of operative interventions in many emergency surgical conditions, relaxed behavior of some surgeons with protracted preoperative preparation, and poverty.

Treatment of the PPU continues to be a controversial subject.<sup>41,42</sup> Emergency surgery is generally considered the treatment of choice.<sup>16,24</sup> There are encouraging results of non-operative therapy in selected patients<sup>17-19</sup> unfortunately, up to 43% of these patients ultimately required surgery for complications,<sup>43</sup> and re-perforation developed in 7.1%.<sup>17</sup> Definitive surgical intervention for PPU is less recommended and only in selected cases.<sup>44,45</sup> Choice of surgical procedure in our patients depended on their age, time of presentation, associated medical

diseases, size of perforated ulcer, severe scarring of the ulcer causing stenosis, and experience of the surgeon; mostly simple closure was preferred. The post-operative complication rate varied between 7.5% and 30% in different studies.<sup>16,34,46,47</sup> Our morbidity rate compares unfavorably with other reports due to inappropriate environment in the operating rooms.

There were some limitations in this study that may affect the accuracy of the results, which included, first, the subjects in the study underwent open repair. On the contrary, current surgical approach in treating PPU is leaning towards laparoscopic repair.<sup>22,23,48</sup> The type and incidence of post-operative complications observed in the present study may not fully represent those after laparoscopic repair. Second, we did not study the association of *H. pylori*, as an important potential factor,<sup>14,49</sup> with post-operative outcomes due to lack of necessary facilities at the hospital, and absence of information in the medical records. Third, since our duration of post-operative follow up was relatively short, we could not estimate the incidence of re-leak after simple closure. However, the purpose of the present investigation was to focus on the current status in the management of patients with PPU admitted to such a teaching hospital.

Post-operative mortality ranges widely at 4.41-30%.<sup>5-7,16,18,21,24,34,50,51</sup> Our results compared favorably with many other reports. Mortality rate after simple closure in our study was significantly lower than after other types of operation, and is in agreement with results reported by Plummer et al<sup>52</sup> (1% for simple closure),<sup>52</sup> and compared well with other reports (4.2% for simple closure).<sup>16</sup> There are reports with much higher (37.5%) mortality rate after closure of PGU than after gastric resections (2.9%).<sup>53</sup> The low mortality rate in our study could be related to younger age of our patients, and the use of effective antibiotics with low resistance of bacteria. The mean post-operative hospital stay period did not differ from other reports (12.76 days).<sup>18</sup>

In conclusion, we found that younger age groups (21-40 years) are frequently affected due to the prevailing young age structure of Yemeni population and earlier *H. pylori* infection. Emphasis should be placed on shortening the time to surgery. Simple closure remains the selected treatment in the majority of patients. The overall post-operative mortality in our patients was low (3.9%). We suggest improving the surgical skills (diagnosis and management) and hospital environment to reduce the duration of perforation time, and the high rate of postoperative complications.

## References

1. Paimela H, Oksala NK, Kivilaakso E. Surgery for peptic ulcer today. A study on the incidence, methods and mortality in surgery for peptic ulcer in Finland between 1987 and 1999. *Dig Surg* 2004; 21: 185-191.
2. Svanes C. Trends in perforated peptic ulcer: incidence, etiology, treatment, and prognosis. *World J Surg* 2000; 24: 277-283.
3. Evans JP, Smith R. Predicting poor outcome in perforated peptic ulcer disease. *Aust NZJ Surg* 1997; 67: 792-795.
4. Arici C, Dinckan A, Erdogan O, Bozan H, Colak T. [Peptic ulcer perforation: an analysis of risk factors]. *Ulus Travma Derg* 2002; 8: 142-146. Turkish
5. Towfigh S, Chandler C, Hines OJ, McFadden DW. Outcomes from peptic ulcer surgery have not benefited from advances in medical therapy. *Am Surg* 2002; 68: 385-389.
6. Testini M, Portincasa P, Piccinni G, Lissidini G, Pellegrini F, Greco L. Significant factors associated with fatal outcome in emergency open surgery for perforated peptic ulcer. *World J Gastroenterol* 2003; 9: 2338-2340.
7. Chou NH, Mok KT, Chang HT, Liu SI, Tsai CC, Wang BW, et. al. Risk factors of mortality in perforated peptic ulcer. *Eur J Surg* 2000; 166: 149-153.
8. Mouret P, François Y, Vignal J, Barth X, Lombard-Platet R. Laparoscopic treatment of perforated peptic ulcer. *Br J Surg* 1990; 77: 1006.
9. Nogueira C, Silva AS, Nunes Santos J, Gomes Silva A, Ferreira J, Matos E, et al. Perforated peptic ulcer: main factors of morbidity and mortality. *World J Surgery* 2003; 27: 782-787.
10. Mäkelä JT, Kiviniemi H, Ohtonen P, Laitinen SO. Factors that predict morbidity and mortality in patients with perforated peptic ulcers. *Eur J Surg* 2002; 168: 446-451.
11. Blomgren LGM. Perforated peptic ulcer: long-term results after simple closure in the elderly. *World J Surgery* 1997; 21: 412-415.
12. Gisbert JP, Legido J, García-Sanz I, Pajares JM. Helicobacter pylori and perforated peptic ulcer prevalence of the infection and role of non-steroidal anti-inflammatory drugs. *Dig Liver Dis* 2004; 36: 116-120.
13. Csáky G, Beszilla J, Sikorszki L, Tóth D. [Surgical treatment of duodenal perforation]. *Magy Seb* 2000; 53: 49-55. Hungarian
14. Ng EK, Lam YH, Sung JJ, Yung MY, To KF, Chan AC, et al. Eradication of Helicobacter pylori prevents recurrence of ulcer after simple closure of duodenal ulcer perforation: randomized controlled trial. *Ann Surg* 2000; 231: 153-158.
15. Kate V, Ananthakrishnan N, Badrinath S. Effect of Helicobacter pylori eradication on the ulcer recurrence rate after simple closure of perforated duodenal ulcer: retrospective and prospective randomized controlled studies. *Br J Surg* 2001; 88: 1054-1058.
16. Gutiérrez de la Peña C, Márquez R, Fakhri F, Domínguez-Adame E, Medina J. Simple closure or vagotomy and pyloroplasty for the treatment of a perforated duodenal ulcer: comparison of results. *Dig Surg* 2000; 17: 225-228.
17. Koyama Y, Hayashi T, Fujita N, Kaneko K, Takano Y, Sato N, et. al. Nonoperative treatment of perforated duodenal ulcer: report of three cases. *Surg Today* 2000; 30: 1034-1036.
18. Crofts TJ, Park KG, Steele RJ, Chung SS, Li AK. A randomized trial of nonoperative treatment for perforated peptic ulcer. *N Engl J Med* 1989; 320: 970-973.
19. Bugnon PY, Rivoalan F, Gautier-Benoit C. [Present status of the Taylor method in perforated ulcer of the duodenal bulb]. *J Chir (Paris)* 1986; 123: 463-466. French
20. Lee FY, Leung KL, Lai PB, Lau JW. Selection of patients for laparoscopic repair of perforated peptic ulcer. *Br J Surg* 2001; 88: 133-136.
21. Lee FY, Leung KL, Lai BS, Ng SS, Dexter S, Lau WY. Predicting mortality and morbidity of patients operated on for perforated peptic ulcers. *Arch Surg* 2001; 136: 90-94.

22. Lunevicius R, Morkevicius M. Systematic review comparing laparoscopic and open repair for perforated peptic ulcer. *Br J Surg* 2005; 92: 1195-1207.
23. Lau H. Laparoscopic repair of perforated peptic ulcer. A meta-analysis. *Surg Endosc* 2004; 18: 1013-1021.
24. Chan WH, Wong WK, Khin LW, Soo KC. Adverse operative risk factors for perforated peptic ulcer. *Ann Acad Med Singapore* 2000; 29: 164-167.
25. Walt R, Katschinski B, Logan R, Ashley J, Langman M. Rising frequency of ulcer perforation in elderly people in the United Kingdom. *Lancet* 1986; 3: 489-492.
26. Gunaid AA, Hassan NA, Murray-Lyon I. Prevalence and risk factors for Helicobacter pylori infection among Yemeni dyspeptic patients. *Saudi Med J* 2003; 24: 512-517.
27. Ministry of Planning and Development, editor. Republic of Yemen statistical yearbook 1989. Sana'a (Yemen): Ministry of Planning; 1990.
28. Rosenstock S, Jørgensen T, Bonnevie O, Andersen L. Risk factors for peptic ulcer disease: a population based prospective cohort study comprising 2416 Danish adults. *Gut* 2003; 52: 186-193.
29. Bulut OB, Rasmussen C, Fischer A. Optimal surgical treatment of complicated peptic ulcers with special reference to the elderly. *World J Surg* 1996; 20: 574-577.
30. Gisbert JP and Pajares JM. Helicobacter pylori Infection and Perforated Peptic Ulcer. *Helicobacter* 2003; 8: 159-167.
31. Stabile BE. Redefining the role of surgery for perforated duodenal ulcer in the Helicobacter pylori era. *Ann Surg* 2000; 231: 159-160.
32. Al-Shrebaty F. Perforated peptic ulcer [dissertation]. Damascus (Syria): Damascus University; 1997.
33. Suleiman A. Perforated peptic ulcer in patients with acute abdomen [dissertation]. Halab (Syria): Halab University; 1997.
34. Kocer B, Surmeli S, Solak C, Unal B, Bozkurt B, Yildirim O, et al. Factors affecting mortality and morbidity in patients with peptic ulcer perforation. *J Gastroenterol Hepatol* 2007; 22: 565-570.
35. Schabowski J, Pitera J. Peptic ulcer among rural population in a selected region of south-eastern Poland. *Ann Agric Environ Med* 2004; 11: 323-327.
36. Andersen IB, Jørgensen T, Bonnevie O, Grønbaek M, Sørensen TI. Smoking and alcohol intake as risk factors for bleeding and perforated peptic ulcers: a population-based cohort study. *Epidemiology* 2000; 11: 434-439.
37. Borén T, Falk P, Roth KA, Larson G, Normark S. Attachment of Helicobacter pylori to human gastric epithelium mediated by blood group antigens. *Science* 1993; 262: 1892-1895.
38. Abu Farsakh NA. Risk factors for duodenal ulcer disease. *Saudi Med J* 2002; 23: 168-172.
39. Sillakivi T, Lang A, Tein A, Peetsalu A. Evaluation of risk factors for mortality in surgically treated perforated peptic ulcer. *Hepatogastroenterology* 2000; 47: 1765-1768.
40. Testini M, Portincasa P, Piccinni G, Lissidini G, Pellegrini F, Greco L. Significant factors associated with fatal outcome in emergency open surgery for perforated peptic ulcer. *World J Gastroenterol* 2003; 9: 2338-2340.
41. Kirkpatrick Jr, Bouwman DL. A logical solution to the perforated ulcer controversy. *Surg Gynecol Obstet* 1980; 150: 683-686.
42. Watkins RM, Dennison AR, Collin J. What has happened to perforated peptic ulcer? *Br J Surg* 1984; 71: 774-776.
43. Keane TE, Dillon B, Afdhal NH, McCormack CJ. Conservative management of perforated duodenal ulcer. *Br J Surg* 1988; 75: 583-584.
44. Hill AG. Management of perforated duodenal ulcer in a resource poor environment. *East Afr Med J* 2001; 78: 346-348.
45. Donovan AJ, Berne TV, Donovan JA. Perforated duodenal ulcer: an alternative therapeutic plan. *Arch Surg* 1998; 133: 1166-1171.
46. Sharma SS, Mamtani MR, Sharma MS, Kulkarni H. A prospective cohort study of postoperative complications in the management of perforated peptic ulcer. *BMC Surg* 2006; 6: 8.
47. Palanivelu C, Jani K, Senthilnathan P. Laparoscopic management of duodenal ulcer perforation: is it advantageous? *Indian J Gastroenterol* 2007; 26: 64-66.
48. Lunevicius R, Morkevicius M. Management strategies, early results, benefits, and risk factors of laparoscopic repair of perforated peptic ulcer. *World J Surg* 2005; 29: 1299-1310.
49. Kumar D, Sinha AN. Helicobacter pylori infection delays ulcer healing in patients operated on for perforated duodenal ulcer. *Indian J Gastroenterol* 2002; 21: 19-22.
50. Korica M, Petaković G, Gavrilović S. [Surgical treatment of perforated gastric ulcer]. *Med Pregl* 2002; 55: 513-516. Croatian
51. Kujath P, Schwandner O, Bruch HP. Morbidity and mortality of perforated peptic gastroduodenal ulcer following emergency surgery. *Langenbecks Arch Surgery* 2002; 387: 298-302.
52. Plummer JM, McFarlane ME, Newnham. Surgical management of perforated duodenal ulcer: the changing scene. *West Indian Med J* 2004; 53: 378-381.
53. Wysocki A, Biesiada Z, Beben P, Budzynski A. Perforated gastric ulcer. *Dig Surg* 2000; 17: 132-137.