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Differences in Inpatient care resource use and postoperative complications among insulin-using diabetes mellitus patients, non-insulin-using diabetes mellitus patients and patients without diabetes mellitus after partial gastrectomy for gastric cancer

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Abstract

The treatment of patients with diabetes mellitus (DM) is enormously expensive in developed countries because of its high prevalence and complications. DM patients often experience microvascular and macrovascular complications that affect their postoperative course, and are at significantly higher risk of postoperative infection and postoperative cardiovascular morbidity and mortality. In addition, few studies have evaluated inpatient care resource use in DM patients who have undergone gastrectomy for gastric cancer. The purpose of this study was to quantify differences in inpatient care resource use and postoperative complications among insulin-using diabetes mellitus patients (IDM), non-insulin-using diabetes mellitus patients (NIDM), and patients without diabetes mellitus (NDM) who had undergone partial gastrectomy for gastric cancer. We analyzed data from 1,805 patients who had undergone partial gastrectomy for gastric cancer. The numbers of patients in the IDM, NIDM, and NDM groups were 82 (4.5%), 61 (3.4%), and 1,662 (92.1%), respectively. The IDM group had a significantly longer length of stay, higher total charge, and higher risk of postoperative complications than the NDM group. However, the NIDM group did not have increased inpatient care resource use or a higher incidence of postoperative complications compared with the NDM group. Healthcare providers should consider the differences in healthcare resource use and postoperative complications between IDM and NIDM patients.

Key words: diabetes mellitus, diabetes-related comorbidities, inpatient care resource use, gastric cancer, surgical complication

❖Introduction

The treatment of patients with diabetes mellitus (DM) is enormously expensive in developed countries because of its high prevalence and complications[1, 16)]. It is estimated that there are 8.9 million DM patients in Japan, and an additional 13.2 million individuals with impaired glucose tolerance[23)]. Among 70,000 insulin users in Japan, approximately 10,000 have type 1 DM

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and the rest have type 2 DM[24, 30]. DM patients have a 50% chance of requiring surgery at some point[29], and nearly 20% of surgical patients have DM[4]. DM has been established as an independent risk factor for postoperative surgical wound infection[7, 8, 11, 25].

Although the incidence and mortality rate of gastric cancer have gradually decreased worldwide, it was predicted that there would still be about 1.1 million patients with gastric cancer in 2010[28]. The mortality rate of gastric cancer is high, and it is the second most common cause of cancer death worldwide[35]. Geographical differences have been observed in the incidence of gastric cancer, with a particularly high incidence in East Asia, including China and Japan[28]. It has been reported that more than 30% of patients with gastric cancer are older than 70 yr[27, 33]. As gastric cancer patients get older, they are likely to suffer from an increasing number of comorbidities[17] and to use more inpatient care resources. A Korean study reported that an increased number of comorbidities correlated with an increased frequency of local complications among 1,237 gastric cancer patients (odds ratio (OR): 1.790; $p<0.001$)[17].

DM patients often experience microvascular and macrovascular complications[12] that affect their postoperative course[5], and are at significantly higher risk of postoperative infection and postoperative cardiovascular morbidity and mortality[3, 10, 20, 22]. The frequency of infection after cardiac surgery is 2–4 times higher among DM patients than among non-DM (NDM) patients[14].

DM patients were also found to have a significantly higher inflation-adjusted total charge (TC) and an increased length of stay (LOS) in hospital following lumbar fusion than NDM patients[2]. However, most studies evaluating inpatient care expenditure and/or postoperative complications did not differentiate between insulin-using DM (IDM) patients and non-insulin-using DM (NIDM) patients[2, 9, 36]. In addition, few studies have evaluated inpatient care resource use in DM patients who have undergone gastrectomy for gastric cancer. Although the prognosis of gastric cancer was shown to differ among stages[26], partial gastrectomy was applied for earlier cases whose prognosis would be better , while total gastrectomy was performed for more advanced cases. Therefore, patients for partial gastrectomy are considered to be comparable to insulin-using diabetes mellitus patients, non-insulin-using patients and patients without diabetes mellitus when information on stages is not available because patients for partial gasterectomy have a more homogeneous prognosis.

The purpose of this study was to investigate the differences in inpatient care resource use and postoperative complications among insulin-using diabetes mellitus patients, non-insulin-using patients and patients without diabetes mellitus after partial gastrectomy for gastric cancer.

❖ Methods

Database and settings

This is a secondary data analysis conducted as a research project during the development of the case-mix classification system sponsored by the Ministry of Health, Labour and Welfare in Japan. We used the Japanese healthcare administrative database of 2003. This system was used to profile hospital performance and to assess per diem payments among 82 academic hospitals (80 university hospitals, the National Cancer Center, and the National Cardiovascular Center) and 92 voluntary community hospitals in 2003. The database contains discharge summaries and claims data, and can therefore be used to determine the amount of healthcare expenditure, the types of surgical procedures performed, the incidences of comorbidities and postoperative complications, and the use of insulin[18].

The records of 283,771 patients discharged from 174 hospitals between July 1 and October 31, 2003, became available for public use in June 2008. We selected the 1,805 patients who had undergone partial gastrectomy for gastric cancer from the dataset, excluding 1 patient who had also undergone lymphadenectomy because this is rarely performed for gastric cancer[17]. None of the patients died within 24 h of admission.

Study variables

The independent variables studied were age, gender, emergency admission, weighted comorbidity score (excluding DM and gastric cancer), rehabilitation, postoperative complications, insulin use, and in-hospital mortality. Patients were divided into IDM, NIDM, and NDM groups. DM was defined for ICD-10 code (E10, E11, E12, E13, and E14). Age was stratified into three categories: under 65 yr, 65–74 yr, and 75 yr or older[21]. Emergency admission was defined as transport to a hospital by an ambulance or emergency hospitaliza-

tion. A maximum of five operative procedures, four comorbidities, and three complications were recorded in the database for each hospitalization. Preexisting comorbidities and postoperative complications were categorized according to the International Classification of Diseases, 10th Revision (ICD-10) codes. Weighted comorbidity scores were calculated using the Charlson comorbidity index (CCI) for all conditions except DM (ICD-10 codes: E10 and E11) and gastric cancer (ICD-10 code: C16). The CCI was categorized into 0, 1, 2, and 3 or more[32]. Postoperative complications were classified into seven groups using their ICD-10 codes: bleeding (K250, K254, K259, K289, K661, and K922), wound problems (T811, T812, T813, T814, T818, T824, T855, and T888), pancreatitis (K85), gastric stasis and stricture (K210), intestinal obstruction (K566), ascites (R18), and others (fistula of stomach and duodenum: K316, functional intestinal disorder other than duodenum: K599, peritonitis: K650, cholecystitis: K810, K811, K819, and cholangitis: K830).

The dependent variables studied were length of stay (LOS, days), total charge (TC, USD 1=JPY 90) billed during admission as a proxy for cost, and postoperative complications. In Japan, hospital charges are determined using a standardized fee-for-service payment system known as the national uniform fee schedule, and these fees are considered to be good estimates of healthcare costs[13]. In this study, the TC included physician fees, instrument costs, laboratory and imaging test costs, and administration fees.

Statistical analysis

Categorical data were reported as frequencies and proportions and were compared between DM groups using Pearson's chi-square test. Age, LOS, and TC are indicated as median and interquartile range and were compared between DM groups using the Kruskal-Wallis test because they did not have a normal distribution. Multiple regression analysis was performed using the forced entry method, where LOS and TC were natural-log-transformed. The coefficient of determination was used as an indicator of how well the regression model fitted the data. Logistic regression analysis was used to identify which factors were associated with postoperative complications. The Hosmer-Lemeshow test was used as an indicator of how well the logistic regression model fitted the data. Statistical analyses were performed using SPSS software version 11.5. All reported P-values are two-tailed, and the level of significance was set at $p<0.05$.

❖Results

The numbers of patients in the IDM, NIDM, and NDM groups were 82 (4.5%), 61 (3.4%), and 1,662 (92.1%), respectively. There was a significant difference in the proportions of patients in different age groups among the DM groups ($p=0.004$). The proportion of males and the CCI score varied significantly among the groups ($p<0.001$). The mortality rate ($p=0.035$) was significantly different among the groups. Postoperative complications were recorded in 142 (7.9%) of 1,805 patients. LOS ($p=0.018$) and TC ($p=0.001$) were significantly different among the groups (Table 1).

Of the 1,805 patients included in this study, 306 (17.0%) had one or more comorbidities. The levels of prevalence of renal disease ($p<0.001$) and connective tissue disorder ($p=0.015$) were significantly different among the DM groups (Table 2).

Multiple regression analyses showed that older age, emergency admission, postoperative complications, higher CCI, and insulin use were significantly associated with increased LOS and higher TC (Table 3). In-hospital mortality was also a significant predictor of increased TC. The presence of comorbidities (OR: 1.867, 95% confidence interval (CI): 1.252–2.784) and IDM (OR: 2.049, 95%CI: 1.072–3.918) were risk factors for postoperative complications (Table 4).

❖Discussion

We investigated differences in inpatient care resource use and the incidence of postoperative complications in patients who had undergone partial gastrectomy for gastric cancer in Japan. The results of this study suggest that older age, emergency admission, postoperative complications, and insulin use were significantly associated with higher inpatient care resource use. Insulin use was significantly associated with postoperative complications.

Multiple regression analysis identified insulin use as an independent risk factor for increased LOS and higher TC. The results of this study show that IDM patients who had undergone partial gastrectomy required significantly more inpatient care resources after controlling for confounding factors. This may be

Table 1 Patient characteristics, care processes, in-hospital mortality and resource use among partial gastrectomy patients for gastric cancer

	DM			p-value
	IDM (n=82)	NIDM (n=61)	NDM (n=1,662)	
Age				0.004††
Under 65 yr	26 (31.7%)	21 (34.4%)	779 (46.9%)	
65–74 yr	40 (48.8%)	26 (42.6%)	522 (31.4%)	
75 yr or older	16 (19.5%)	14 (23.0%)	361 (21.7%)	
Median age (years) [IQ]	65 [10]	65 [10]	65 [15]	0.023†
Male	62 (75.6%)	54 (88.5%)	1,104 (66.4%)	<0.001††
Emergency admission	7 (8.5%)	2 (3.3%)	117 (7.0%)	0.449††
Charlson comorbidity index				0.001††
0	61 (74.4%)	43 (70.5%)	1,395 (83.9%)	
1	7 (8.5%)	12 (19.7%)	162 (9.7%)	
2	11 (13.4%)	3 (4.9%)	59 (3.5%)	
3 or more	3 (3.7%)	3 (4.9%)	46 (2.8%)	
Rehabilitation	5 (6.1%)	1 (1.6%)	82 (4.9%)	0.437††
Complications	12 (14.6%)	6 (9.8%)	124 (7.5%)	0.053††
Bleeding	6 (7.3%)	1 (1.6%)	49 (2.9%)	0.067††
Wound infection	4 (4.9%)	1 (1.6%)	36 (2.2%)	0.259††
Pancreatitis	1 (1.2%)	4 (6.6%)	20 (1.2%)	0.002††
Stasis or stricture	1 (1.2%)	1 (1.6%)	8 (0.5%)	0.346††
Ascites	1 (1.2%)	0 (0.0%)	0 (0.0%)	<0.001††
Obstruction	0 (0.0%)	0 (0.0%)	1 (0.1%)	0.958††
Others	0 (0.0%)	1 (1.6%)	19 (1.1%)	0.578††
In-hospital mortality	2 (2.4%)	0 (0.0%)	7 (0.4%)	0.035††
Median LOS (days) [IQ]	30 [25.25]	26 [12.00]	25 [15.00]	0.018†
Median TC (USD) [IQ]	17,119 [9,656]	15,439 [4,845]	15,189 [4,577]	0.001†

DM, diabetes mellitus; IDM, insulin use DM patients; NIDM, non insulin use DM patients; NDM, non DM patients; Charlson comorbidity index, excluding DM and gastric cancer; Others, fistula of stomach and duodenum, functional intestinal disorder but duodenum, peritonitis, cholecystitis and cholangitis; IQ, interquartile range; † tested by Kraskull-Wallis, †† tested by Pearson's chi-square test.

Table 2 Patient comorbidities among partial gastrestomy patients for gastric cancer

	DM			p-value
	IDM (n=82)	NIDM (n=61)	NDM (n=1,662)	
Peptic ulcer	7 (8.5%)	3 (4.9%)	88 (5.3%)	0.442
Cancer (excluding gastric cancer)	6 (7.3%)	2 (3.3%)	57 (3.4%)	0.181
Metastatic cancer	2 (2.4%)	2 (3.3%)	34 (2.0%)	0.786
Pulmonary disease	0 (0.0%)	3 (4.9%)	31 (1.9%)	0.099
Cerebral vascular accident	3 (3.7%)	2 (3.3%)	21 (1.3%)	0.097
Acute myocradial infraction	0 (0.0%)	1 (1.6%)	18 (1.1%)	0.580
Liver disease	0 (0.0%)	1 (1.6%)	15 (0.9%)	0.568
Peripheral vascular disease	1 (1.2%)	1 (1.6%)	11 (0.7%)	0.581
Renal disease	4 (4.9%)	2 (3.3%)	7 (0.4%)	<0.001
Connective tissue disorder rheumatic disease	2 (2.4%)	1 (1.6%)	6 (0.4%)	0.015
Congestive heart failure	1 (1.2%)	1 (1.6%)	7 (0.4%)	0.265

DM, diabetes mellitus; IDM, insulin use DM patients; NIDM, non insulin use DM patients; NDM, non DM patients; tested by Pearson's chi-square test.

Table 3 Multiple regression analyses of factors associated with length of stay (days) and total charge (US$)

Partial gastrectomy (n=1,805)	Log LOS			Log TC		
Independent variables	Estimation	S.E.	p-value	Estimation	S.E.	p-value
Intercept	3.143	0.020	<0.001	9.588	0.012	<0.001
Age (for under 65 yr)						
65–74 yr	0.113	0.022	<0.001	0.058	0.014	<0.001
75 yr or older	0.173	0.025	<0.001	0.089	0.016	<0.001
Male	0.010	0.021	0.612	0.031	0.013	0.016
Emergency admission	0.296	0.038	<0.001	0.220	0.023	<0.001
Charlson comorbidity index (for zero)						
1	0.027	0.032	0.402	0.030	0.020	0.130
2	0.150	0.049	0.002	0.099	0.030	0.001
3 or more	0.129	0.058	0.025	0.145	0.036	<0.001
Rehabilitation	–0.012	0.045	0.783	0.009	0.028	0.739
Complication						
Present	0.111	0.036	0.002	0.108	0.022	<0.001
DM groups (for NDM)						
NIDM	–0.025	0.053	0.638	–0.015	0.033	0.646
IDM	0.118	0.047	0.012	0.128	0.029	<0.001
In-hospital mortality	–0.002	0.137	0.990	0.323	0.084	<0.001
Coefficient of determination		0.083			0.124	

p values by F-test. p<0.001. S.E., standard error; Charlson comorbidity index, excluding DM and gastric cancer; DM, diabetes mellitus; NDM, non DM patients; NIDM, non insulin use DM patients; IDM, insulin use DM patients.

Table 4 Logistic regression analysis of risk factors associated with complications

Partial gastrectomy (n=1,805)	Odd ratio	[95%CI]
Age		
Under 65 yr	1.000	
65–74 yr	0.874	[0.585–1.305]
75 yr or older	0.939	[0.599–1.471]
Gender		
Female	1.000	
Male	1.018	[0.700–1.482]
Emergency admission		
Abest	1.000	
Present	0.669	[0.305–1.467]
Charlson comorbidity index		
0	1.000	
1 or more	1.867	[1.252–2.784]
DM groups		
NDM	1.000	
NIDM	1.233	[0.515–2.953]
IDM	2.049	[1.072–3.918]

Hosmer-Lemeshow goodness for fit. p=0.991. CI, confidential interval; Charlson comorbidity index, excluding DM and gastric cancer; DM, diabetes mellitus; NDM, non DM patients; NIDM, non insulin use DM patients; IDM, insulin use DM patients.

because the IDM group had higher frequencies of emergency admission and comorbidities than the NDM group, which increased the risk of postoperative complications. We found that the IDM group had a significantly longer LOS than the NIDM and NDM groups (33 d, 26 d, and 26 d, respectively; $p<0.001$) and a significantly greater TC ($19,988, $15,439, and $16,273, respectively; $p<0.001$).

Some previous studies investigated the impact of DM on healthcare resource use and on the incidence of postoperative complications in surgical patients[2, 9, 36] and showed that DM patients have a higher risk of postoperative complications and mortality than NDM patients[3, 10, 20]. One study reported that DM was significantly associated with postoperative infection, in-hospital mortality, higher TC, and longer LOS[2]. Yamashita *et al.* found that long-term DM (longer than 10 yr) had a particularly significant correlation with the development of postoperative complications after gastrectomy[36]. Another study investigating the impact of DM on patient outcomes after ankle fracture reported that DM patients across all levels of fracture severity remained in hospital for about one additional day (mean: 4.7 d versus 3.6 d) and incurred more than $2,000 in extra charges (mean: $12,898 versus $10,794)[9]. However, these studies did not examine the impact of insulin use on resource use and did not determine whether there was a significant difference in resource use between NIDM and NDM groups. It was previously reported that IDM patients have significantly higher postoperative complication rates, longer LOS, and higher hospital charges than NIDM or NDM patients[31]. These results were consistent with the results of the present study, which also found that IDM patients had a longer LOS and higher TC.

DM is now one of the most common non-communicable diseases globally. Type 2 DM is sometimes called adult-onset DM, and accounts for 90% of all DM cases[15]. As type 2 DM may progress to a point where there is insufficient insulin secretion[34], some patients require insulin supplementation therapy for good glycemic control[6] and 27% of patients with type 2 DM in the US now use insulin[19]. It is important to prevent progression to insulin use among type 2 DM patients because IDM was found to be significantly associated with increased resource use compared with NIDM.

There are two limitations to this study. First, information was only gathered from patients discharged during a 4-month period in 2003. This limits the ability to generalize the results. In addition, this study lacks analysis of clinical information, such as the pathology of the gastric malignancy, the reconstruction method employed, and laboratory test values that are likely to be associated with LOS or TC. Nevertheless, ICD-10-coded comorbidities and insulin use could be suitable proxies for clinical parameters that were not recorded in the database.

In conclusion, we found that IDM patients had longer LOS and higher TC, and a higher incidence of postoperative complications, than NDM patients, but we did not find differences in LOS or TC between NIDM and NDM patients. Healthcare providers should consider the differences in inpatient care resource use and postoperative complications between IDM and NIDM patients.

❖ References

1) American Diabetes Association: Economic costs of diabetes in the U.S. in 2007. Diabetes Care 31, 596–615 (2008).
2) Browne JA, Cook C, Pietrobon R, et al.: Diabetes and early postoperative outcomes following lumbar fusion. Spine 32, 2214–2219 (2007).
3) Chen SY, Zhou YB, Wang H, et al.: Risk factors of intra-abdominal infection following gastrectomy in gastric cancer patients. Zhonghua Wei Chang Wai Ke Za Zhi 12, 137–140 (2009) (in Chinese).
4) Clement S, Braithwaite SS, Magee MF, et al.: Management of diabetes and hyperglycemia in hospitals. Diabetes Care 27, 553–591 (2004).
5) Coursin DB, Connery LE, Ketzler JT: Perioperative diabetic and hyperglycemic management issues. Crit Care Med 32, 116–125 (2004).
6) DeWitt DE, Hirsch IB: Outpatient insulin therapy in type 1 and type 2 diabetes mellitus: a scientific review. JAMA 289, 2254–2264 (2003).
7) Furnary AP, Zerr KJ, Grunkemeier GL, et al.: Continuous intravenous insulin infusion reduces the incidence of deep sternal wound infection in diabetic patients after cardiac surgical procedures. Ann Thorac Surg 67, 352–362 (1999).
8) Gadaleta D, Risucci DA, Nelson RL, et al.: Effects of morbid obesity and diabetes mellitus on risk of coronary artery bypass grafting. Am J Cardiol 70, 1613–1614 (1992).
9) Ganesh SP, Pietrobon R, Cecilio WA, et al.: The impact of diabetes on patient outcomes after ankle

fracture. J Bone Joint Surg Am 87, 1712–1718 (2005).
10) Gil-Bona J, Sabate A, Pi A, et al.: Mortality risk factors in surgical patients in a tertiary hospital: a study of patient records in the period 2004–2006. Cir Esp 85, 229–237 (2009).
11) Grossi EA, Esposito R, Harris LJ, et al.: Sternal wound infections and use of internal mammary artery grafts. J Thorac Cardiovasc Surg 102, 342–347 (1991).
12) Haffner SM, Lehto S, Ronnemaa T, et al.: Mortality from coronary heart disease in subjects with type 2 diabetes and in nondiabetic subjects with and without prior myocardial infarction. N Engl J Med 339, 229–234 (1998).
13) Hayashida K, Imanaka Y, Otsubo T, et al.: Development and analysis of a nationwide cost database of acute-care hospitals in Japan. J Eval Clin Pract 15, 626–633 (2009).
14) Hoogwerf BJ, Sheeler LR, Licata AA: Endocrine management of the open heart surgical patient. Semin Thorac Cardiovasc Surg 3, 75–80 (1991).
15) International Diabetes Federation. http://www.idf.org/types-diabetes. (access 22 July, 2011).
16) Jamison DT, Breman JG, Measham AR, et al. (2006) Disease Control Priorities in Developing Countries, Oxford University Publishing, New York.
17) Kim W, Song KY, Lee HJ, et al.: The impact of comorbidity on surgical outcome in laparoscopy-assisted distal gastrectomy: a retrospective analysis of multicenter results. Ann Surg 248, 793–799 (2008).
18) Kuwabara K, Imanaka Y, Matsuda S, et al.: Impact of age and procedure on resource use for patients with ischemic heart disease. Health Policy 85, 196–206 (2008).
19) Koro CE, Bowlin SJ, Bourgeois N, et al.: Glycemic control from 1988 to 2000 among U.S. adults diagnosed with type 2 diabetes: a preliminary report. Diabetes Care 27, 17–20 (2004).
20) Lange CP, Ploeg AJ, Lardenoye JW, et al.: Patient- and procedure-specific risk factors for postoperative complications in peripheral vascular surgery. Qual Saf Health Care 18, 131–136 (2009).
21) Levinsky NG, Yu W, Ash A, et al.: Influence of age on Medicare expenditures and medical care in the last year of life. JAMA 286, 1349–1355 (2001).
22) Malone DL, Genuit T, Tracy JK, et al.: Surgical site infections: reanalysis of risk factors. J Surg Res 103, 89–95 (2002).
23) Ministry of Health, Labour and Welfare, Japan. http://www.mhlw.go.jp/houdou/2008/12/h1225-5.html. (access 17 June 2011).
24) Ministry of Health, Labour and Welfare, Japan. http://www.mhlw.go.jp/shingi/2007/03/s0312-10.html. (access 17 June 2011).
25) Ngaage DL, Jamali AA, Griffin S, et al.: Non-infective morbidity in diabetic patients undergoing coronary and heart value surgery. Eur J Cardiothorac Surg 35, 255–259 (2009).
26) National Cancer Center Hospital (NCCH), Japan: Gastric cancer research group (new cased admitted to NCCH during 1990–1994) (2003) http://www.ncc.go.jp/jp/. (access 17 June 2011)
27) Oohara T, Johjima Y, Yamamoto O, et al.: Gastric cancer in patients above 70 years of age. World J Surg 8, 315–320 (1984).
28) Parkin DM, Bray F, Ferlay J, et al.: Global cancer statistics, 2002. CA Cancer J Clin 55, 74–108 (2005).
29) Root HF: Preoperative medical care of the diabetic patient. Postqrad Med 40, 439–444 (1966).
30) Sanke H, Hirose T, Kawamori R: On the occasion of insulin injection, wash hands to what extent. J Practice Diabetes 25, 189–193 (2008).
31) Stewart RD, Lahey SJ, Levitsky S, et al.: Clinical and economic impact of diabetes following coronary artery bypass. J Surg Res 76, 124–130 (1998).
32) Sundararajana V, Hendersona T, Perrya C, et al.: New ICD-10 version of the Charlson Comorbidity Index predicted in-hospital mortality. J Clin Epidemiol 57, 1288–1294 (2004).
33) Takeda J, Tanaka T, Koufuji K, et al.: Gastric cancer surgery in patients aged at least 80 years old. Hepatogastroentrerology 41, 516–520 (1994).
34) UK Prospective Diabetes Study Group: Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes. Lancet 352, 837–853 (1998).
35) WHO cancer. http://www.who.int/mediacentre/factsheets /fs297/en/index.html. (access 17 June 2011).
36) Yamashita S, Yamaguchi H, Sakaguchi M, et al.: Longer-term diabetic patients have a more frequent incidence of nosocomial infections after elective gastrectomy. Anesth Analg 91, 1176–1181 (2000).