



Quality of life after subtotal gastrectomy for gastric cancer: Does restoration method matter? – A retrospective cohort study



Edgaras Smolskas^{a,*}, Raimundas Lunevicius^b, Narimantas Evaldas Samalavicius^c

^a Vilnius University Hospital Santariskes Clinics, 2 Santariskiu Str, LT-08661, Vilnius, Lithuania

^b Emergency General Surgery and Major Trauma Centre, General Surgery Department, Aintree University Hospital NHS Foundation Trust, Lower Lane, Liverpool, L9 7AL, United Kingdom

^c Clinic of Internal Diseases, Family Medicine and Oncology of Medical Faculty, Institute of Oncology, Vilnius University, 1 Santariskiu Str, LT-08660, Vilnius, Lithuania

HIGHLIGHTS

- The QoL after a subtotal gastrectomy in patients with gastric cancer was evaluated.
- A list of patients was stratified into 3 arms – Billroth I, Balfour, and Roux-en-Y.
- The best QoL scores were obtained after the Billroth I surgery.

ARTICLE INFO

Article history:

Received 8 April 2015

Received in revised form

9 August 2015

Accepted 31 August 2015

Keywords:

Stomach neoplasms

Gastric cancer

Distal gastrectomy

Quality of life

ABSTRACT

Introduction: The aim of this study was to evaluate the impact on the quality of life (QoL) status of three gastrointestinal continuity restoration methods following a subtotal gastrectomy in patients with gastric cancer.

Methods: QoL data from 153 patients were obtained and evaluated in this retrospective cross-sectional case series study. A list of patients who responded to questionnaires on QoL was stratified into three arms based on which gastrointestinal continuity restoration method was used – Billroth I (n = 37), Roux-en-Y (n = 15), and Balfour (n = 101).

Results: The mean global health status scores for the patients following the Billroth I, Roux-en-Y and Balfour reconstructive surgery arms were 62 ± 20.09 , 61 ± 24.08 and 56 ± 21.2 , respectively, ($p = 0.182$). The mean scores of the functional scales were not lower than 60 in any of the patient groups. For physical, role, cognitive, social functional scales, the Billroth I method had the best mean QoL score. Comparisons of the global QoL, functional activities, and majority of the postgastrectomy symptom scores at different time points after the surgeries (6–12 months vs > 1 year) did not reveal major significant differences between the groups. However, the results highlighted trends and ranked the gastrointestinal continuity restoration methods over time.

Conclusions: The best QoL scores were obtained from the patients who underwent the Billroth I surgery. The Roux-en-Y method was better than the Balfour method 6–12 months after surgery. However, the Balfour method was better than the Roux-en-Y after one year. Further prospective randomized controlled trials are needed.

© 2015 The Authors. Published by Elsevier Ltd on behalf of IJS Publishing Group Limited. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

There is no consensus regarding the choice of a gastrointestinal continuity restoration method following a subtotal gastrectomy for gastric cancer [1]. When feasible, a Billroth I reconstruction method is commonly performed because it is technically simple. However, bile reflux develops in 8.4–56.3% of gastric cancer patients who undergo this procedure [1–3]. Subsequently, severe gastritis and

* Corresponding author.

E-mail addresses: edgaras.smolskas@gmail.com (E. Smolskas), raimundas.lunevicius@aintree.nhs.uk (R. Lunevicius), narimantas.samalavicius@nvi.lt (N.E. Samalavicius).

esophagitis are also reported after a Billroth I operation [4,5]. Conversely, the incidence of bile reflux and reflux remnant gastritis at 12 months following surgery with a Roux-en-Y gastrointestinal reconstruction method is only 8–16% [6,7]. However, Roux stasis syndrome occurs in 10–30% of patients [8,9]. There is a lack of data on side effects and quality of life after the Balfour method for gastrointestinal continuity restoration.

We aimed to evaluate the impact on the global quality of life (QoL) status after the Billroth I, Balfour, and Roux-en-Y gastrointestinal continuity restoration methods following a subtotal gastrectomy in gastric cancer patients. These surgeries were performed as standard procedures at the National Institute of Oncology of Vilnius University, Lithuania. The decision on which reconstruction method was performed was made by a surgeon.

2. Material and methods

The Lithuanian version of the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30) was used to assess the QoL in this retrospective cross-sectional case series study [10]. The EORTC-QLQ-C30 was sent to 266 gastric cancer patients for self-completion. All the patients had undergone a R0 subtotal gastrectomy for gastric cancer from July 2007 to July 2012. The study participants were informed of the objectives of this questionnaire and confidentiality policy.

QoL data from the 153 patients who responded to the questionnaires following a subtotal gastrectomy for gastric cancer were obtained and evaluated. A list of questionnaire responders was stratified into three arms named based on the gastrointestinal continuity restoration method performed – Billroth I (37 cases), Balfour (101 cases), and Roux-en-Y (15 cases) (Fig. 1). The mean scores with standard deviations of global health status, functional and symptom scales were compared between these three arms. The mean time after operation was 2.5 years with a range of 0.5–5 years.

The main characteristics of the enrolled patients as well as the peculiarities of the gastric cancer and its management are shown in Table 1. The sex, median age, cancer stage, and treatment modes in the three arms were similar. None of the patients had distant metastatic cancer at the time of surgery or questionnaire. A subtotal gastrectomy was generally performed with a conventional D1 or D2 lymphadenectomy [11]. The size of the remnant stomach was independent of the type of gastric reconstruction and averaged 20% of the stomach. In the Billroth I reconstructions, the duodenum and remnant stomach were anastomosed using a hand-sewn method. When the Balfour modification was employed, an antecolic end-to-side gastrojejunostomy was performed on a long loop using a hand-sewn method. Braun's jejunojunostomy was performed 20 cm below the gastrojejunostomy. The Roux-en-Y reconstruction of the gastrointestinal tract involved a division of the jejunum 20 cm distal to the Treitz ligament. The Roux limb was brought through the antecolic (nine patients) or retrocolic (six patients) route. An end-to-side gastrojejunostomy was anastomosed using a hand-sewn method. The continuity of the jejunum was subsequently reconstructed by hand-sewn jejunojunostomy.

Statistical significance between the groups was analyzed by Student's t-test, an independent-samples T test, a one-way ANOVA, and Kruskal–Wallis H tests. All statistical analyses were performed using SPSS software, version 20.0.

3. Results

Table 2 shows the means and standard deviations of the global health status, functional and symptom scales of the Billroth I, Roux-Y and Balfour arms. The mean global health status scores for the

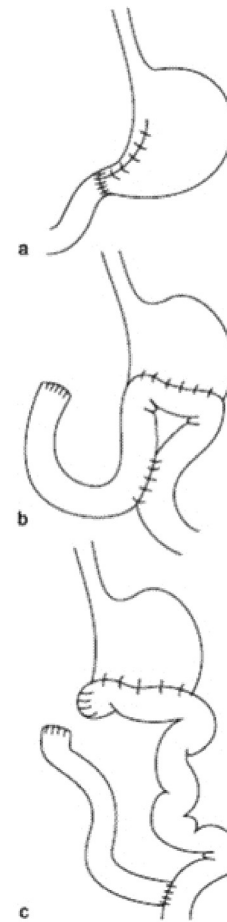


Fig. 1. The schemes of the gastrointestinal continuity restoration techniques; a: Billroth I; b: Balfour; c: Roux-en-Y.

patients following the Billroth I, Roux-en-Y, and Balfour reconstructive surgeries were 62 ± 20.09 , 61 ± 24.08 and 56 ± 21.20 , respectively, ($p = 0.182$). The mean scores of the functional scales were not lower than 60 in any of the patient groups. For most of the functional scales (i.e., physical, role, cognitive, and social), the mean of QoL score was best in the Billroth I and worst in the Roux-en-Y arms. Of eight postoperative symptoms, no statistically significant differences between the arms were found.

Comparisons of the global QoL, functional activities, and majority of the postgastrectomy symptom scores at different time points after surgery (≤ 1 year vs > 1 year) did not reveal major significant differences between the groups. Fig. 2 shows the mean values of the functional scales after 6–12 months and > 1 year. Fig. 2 also shows that the patients scored better following the Roux-en-Y and Balfour gastrointestinal continuity restoration compared to the Billroth I surgery after 6–12 months. However, after more than one year, the functional scales scores were compared between the patient groups, and the QoL was better following the Billroth I and Balfour procedures.

The mean values of the symptom scores in the Billroth I, Balfour, and Roux-en-Y gastrointestinal continuity restoration arms after 6–12 months and > 1 year after surgery are shown in Fig. 3. The lower symptom scores reflect a better condition. Fig. 3 highlights the trends and ranks of the gastrointestinal continuity restoration methods over the time. The first 6–12 months after surgery, the rank is (in descending order): Roux-en-Y, Balfour, and Billroth I. After 1 year the ranking is (in descending order): Billroth I, Balfour, and Roux-en-Y.

Table 1

The main characteristics of the enrolled patients as well as the peculiarities of the gastric cancer and its management in the Billroth I, Roux-Y and Balfour arms.

Characteristics	Billroth I, n = 37	Roux-en-Y, n = 15	Balfour, n = 101
Sex			
Male	17 (45.9%)	7 (46.7%)	51 (50.5%)
Female	20 (54.1%)	8 (53.3%)	50 (49.5%)
Age median (standard deviation)	67 (\pm 12)	62 (\pm 13)	67 (\pm 13)
Depth of invasion			
T1	15 (40.5%)	7 (46.7%)	39 (38.6%)
T2	8 (21.6%)	1 (6.7%)	33 (32.7%)
T3	13 (35.1%)	5 (33.3%)	27 (26.7%)
T4	1 (2.7%)	2 (13.3%)	2 (2.0%)
Lymph node metastasis			
N0	22 (59.5%)	11 (73.3%)	56 (55.4%)
N1	10 (2.7%)	0	27 (26.7%)
N2	5 (13.5%)	1 (6.7%)	12 (11.9%)
N3	0	3 (20%)	6 (5.9%)
Stage			
I	18 (48.6%)	8 (53.3%)	53 (52.5%)
II	10 (27.0%)	3 (20%)	31 (30.7%)
III	9 (24.3%)	4 (26.7%)	17 (16.8%)
IV	0	0	0
Lymphadenectomy			
D1	0	3 (20%)	0
D2	37 (100%)	12 (80%)	101 (100%)
Adjuvant chemotherapy			
Yes	13 (35.1%)	4 (26.7%)	31 (30.7%)
No	22 (64.9%)	11 (73.3%)	70 (69.3%)
Time after surgery			
\leq 1 year	6 (16.2%)	3 (20%)	21 (20.8%)
$>$ 1 year	31 (83.8%)	12 (80%)	80 (79.2%)

No significant differences found.

4. Discussion

Health-related quality of life is becoming an important component of outcomes in cancer therapy [12]. It is well known that patients who survive gastric cancer surgery may suffer from various nutritional and functional symptoms. We used the EORTC QLQ-C30 to assess the impact of the gastrointestinal reconstruction method on the global quality of life after a subtotal gastrectomy in gastric cancer patients.

The results of our study show that the patients' global QoL status was not significantly affected by the gastrointestinal continuity restoration method used – Billroth I, Roux-en-Y, or Balfour – following a subtotal gastrectomy for gastric cancer. This finding corresponds to findings of other investigators who demonstrated

that there is no statistically significant difference in the QoL between the Roux-en-Y, Billroth I, and Billroth II groups [1,13]. Conversely, there are data showing that the Roux-en-Y reconstruction gives better clinical outcomes and QoL than the Billroth I procedure because it reduces the occurrence of reflux esophagitis and diarrhea [14,15]. Our study augments this claim because it includes an evaluation of the Balfour procedure on the QoL, which resulted in several findings.

First, the physical functioning, cognitive and social QoL scales of the patients were better following the Billroth I procedure. Second, most of the functional activity scores favored the Balfour gastrointestinal continuity restoration method compared to the Roux-en-Y method, despite the fact that the global QoL score was higher in the Roux-en-Y surgery arm, which was quite difficult to interpret. However, the severity of postoperative symptoms was higher in the Roux-en-Y surgery arm compared with the Balfour surgery arm 1 year after surgery (Fig. 3). The lower severity of postoperative symptoms in the Roux-en-Y surgery arm compared to the Balfour surgery arm 6–12 months after the operation was very likely the key factor that influenced the higher global QoL score for the Roux-en-Y surgery. Thus, this finding is a good starting point for a further prospective comparative study in which the Roux-en-Y can be compared with the Balfour modification in two homogeneous gastric cancer patient cohorts. Third, while evaluating the impact of time (\leq 1 year vs $>$ 1 year) after each gastrointestinal restoration procedure on the QoL, the long-term effects on the QoL for the patients more than one year after surgery were better following the Billroth I and Balfour procedures compared with the Roux-en-Y surgery.

These results supplement findings of other investigators who showed that, after a gastrectomy, gastric cancer patients generally suffer more from postgastrectomy symptoms during the first few months [16–18]. One important factor in the disparity in the QoL is the difference in postgastrectomy symptoms between the 5-year survival and healthy population [19].

Table 2

The means and standard deviations of the global health status, functional and symptom scales in the Billroth I, Roux-Y and Balfour arms.

Scales	Billroth I	Roux-en-Y	Balfour	p value**
Global health status*	62 \pm 20.09	61 \pm 24.08	56 \pm 21.20	0.182
Functional scales*				
Physical	71 \pm 21.80	64 \pm 31.35	69 \pm 21.73	0.767
Role	70 \pm 28.90	66 \pm 35.34	72 \pm 31.86	0.703
Emotional	68 \pm 26.97	71 \pm 24.77	64 \pm 26.30	0.533
Cognitive	76 \pm 20.99	69 \pm 36.11	72 \pm 27.56	0.918
Social	72 \pm 30.44	61 \pm 38.14	70 \pm 31.60	0.688
Symptom scales*				
Fatigue	50 \pm 30.39	43 \pm 27.37	49 \pm 27.91	0.765
Nausea and vomiting	18 \pm 22.20	14 \pm 35.00	13 \pm 21.25	0.134
Pain	28 \pm 28.02	38 \pm 36.99	34 \pm 29.32	0.534
Dyspnea	20 \pm 29.88	22 \pm 34.88	21 \pm 31.57	0.999
Insomnia	50 \pm 32.03	56 \pm 37.09	49 \pm 33.53	0.771
Appetite loss	28 \pm 33.81	40 \pm 38.21	23 \pm 28.18	0.225
Constipation	26 \pm 31.98	22 \pm 37.09	19 \pm 29.68	0.433
Diarrhea	28 \pm 31.37	24 \pm 26.62	25 \pm 30.10	0.890

* a higher score denotes a better quality of life, either global or functional; higher scores for the symptom scales show problems which negatively influence quality of life; **p value was calculated using Kruskal–Wallis H test.

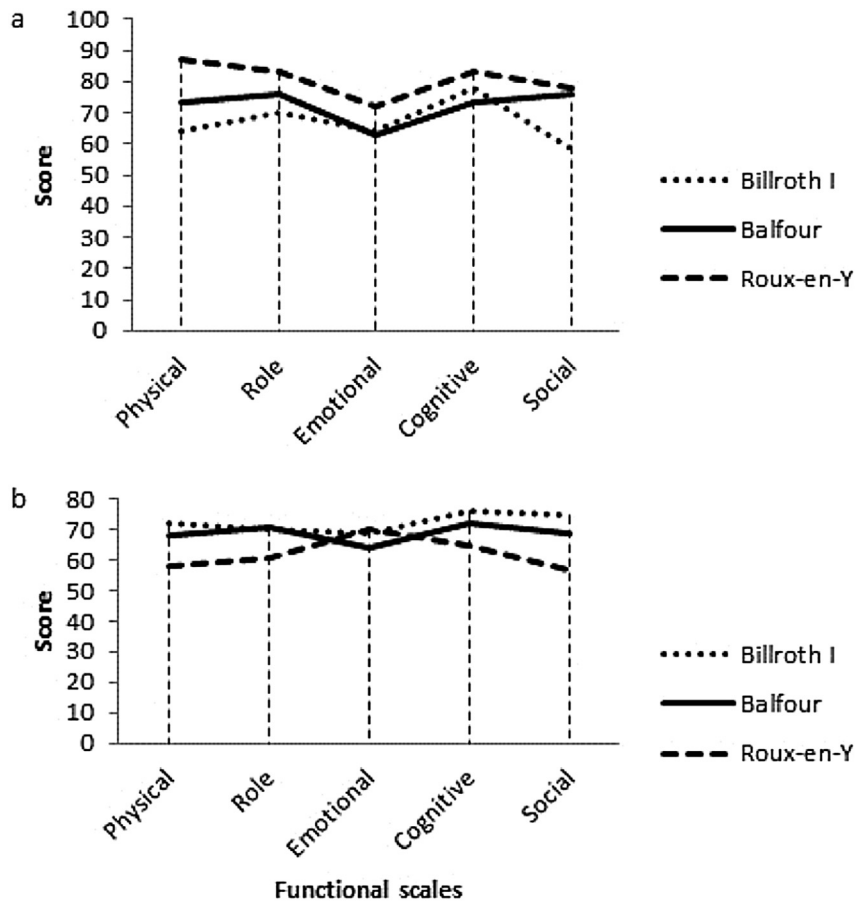


Fig. 2. The mean values of the five functional scales in the Billroth I, Balfour, and Roux-en-Y gastrointestinal continuity restoration arms. a: 6–12 months; b: >1 year.

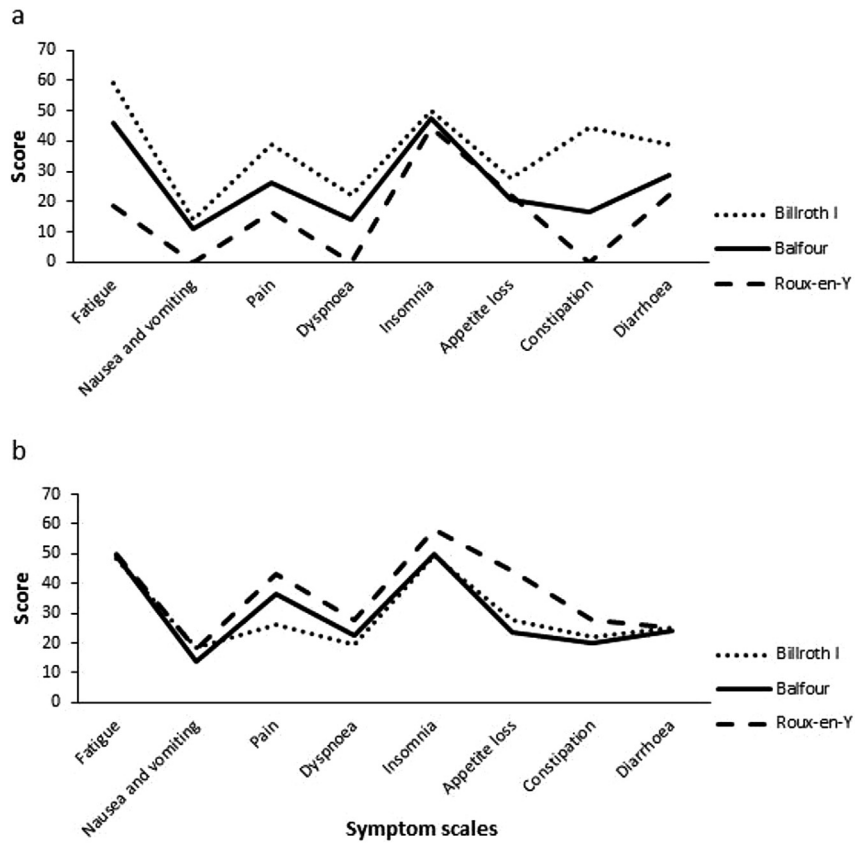


Fig. 3. The mean values of the eight symptom scales in the Billroth I, Balfour, and Roux-en-Y gastrointestinal continuity restoration arms. a: 6–12 months; b: >1 year.

5. Conclusion

Our study demonstrates that the type of gastrointestinal continuity restoration method does not significantly affect a patient's QoL after surgery. This means that both the Balfour and Roux-en-Y methods may be equally and broadly suitable in practise. The application of the Billroth I procedure is limited in gastric cancer surgery. Nevertheless, we have to conclude that the best global QoL score was obtained after the Billroth I surgery. Furthermore, an assessment of the values of the functional activity and symptom scales revealed that the Roux-en-Y modification is better than the Balfour gastrointestinal continuity restoration method in five functional categories and seven of eight postoperative symptom categories 6–12 months after surgery. On the contrary, the same methodological assessment of the values from both scales has shown that the Balfour modification is better than the Roux-en-Y gastrointestinal continuity restoration method in four of five functional categories and in all eight postoperative symptom categories one year after surgery. Further well-designed prospective randomized trials comparing QoLs following the Roux-en-Y and Balfour surgeries are needed. Future trials should include the supplementary gastric cancer module QLQ-STO22 for a more detailed QoL assessment.

Competing interests

All of the authors declare that there are no conflicts of interest and have accepted no financial sponsorship in producing and presenting this manuscript. Each author listed is in agreement with the content of the manuscript.

Conflicts of interest

All the authors declare that there are no conflicts of interest.

Sources of funding

All the authors have accepted no financial sponsorship in producing and presenting this manuscript.

Ethical approval

This study was approved by local ethics committee.

Author contribution

Edgaras Smolskas conducted the study, performed the literature search and wrote the paper. Raimundas Lunevicius performed literature search, supervised the project and made critical revisions. Narimantas Evaldas Samalavicius designed the study.

Guarantor

Narimantas Evaldas Samalavicius

Clinic of Internal Diseases, Family Medicine and Oncology of Medical Faculty, Institute of Oncology, Vilnius University, 1 Santariskiu Str, LT-08660, Vilnius, Lithuania; E-mail: narimantas.samalavicius@vuo.lt.

References

- [1] M.S. Lee, S.H. Ahn, J.H. Lee, J. Park do, H.J. Lee, H.H. Kim, H.K. Yang, N. Kim, W.W. Lee, What is the best reconstruction method after distal gastrectomy for gastric cancer? *Surg. Endosc.* 26 (2012) 1539–1547.
- [2] S. Nunobe, A. Okaro, M. Sasako, M. Saka, T. Fukagawa, H. Katai, T. Sano, Billroth I versus Roux-en-Y reconstructions: a quality-of-life survey at 5 years, *Int. J. Clin. Oncol.* 12 (2007) 433–439.
- [3] M. Ishikawa, J. Kitayama, S. Kaizaki, H. Nakayama, H. Ishigami, S. Fujii, H. Suzuki, T. Inoue, A. Sako, M. Asakage, H. Yamashita, K. Hatono, H. Nagawa, Prospective randomized trial comparing Billroth I and Roux-en-Y procedures after distal gastrectomy for gastric carcinoma, *World J. Surg.* 29 (2005) 1415–1420.
- [4] J.E. Richter, Duodenogastric reflux-induced (alkaline) esophagitis, *Curr. Treat. Options Gastroenterol.* 7 (2004) 53–58.
- [5] H. Osugi, K. Fukuhara, N. Takada, M. Takemura, H. Kinoshita, Reconstructive procedure after distal gastrectomy to prevent remnant gastritis, *Hepatogastroenterology* 51 (2004) 1215–1218.
- [6] K. Shinoto, T. Ochiai, T. Suzuki, S. Okazumi, M. Ozaki, Effectiveness of Roux-en-Y reconstruction after distal gastrectomy based on an assessment of biliary kinetics, *Surg. Today* 33 (2003) 169–177.
- [7] C.D. Chan, Y.M. Fan, C.K. Lin, C.J. Chen, C.Y. Chen, Y.C. Chao, Roux-en-Y reconstruction after distal gastrectomy to reduce enterogastric reflux and *Helicobacter pylori* infection, *J. Gastrointest. Surg.* 11 (2007) 1732–1740.
- [8] S. Gustavsson, D.M. Ilstrup, P. Morrison, K.A. Kelly, Roux-Y stasis syndrome after gastrectomy, *Am. J. Surg.* 3 (1988) 490–494.
- [9] M. Bar-Natan, G.M. Larson, G. Stephens, T. Massey, Delayed gastric emptying after gastric surgery, *Am. J. Surg.* 1 (1996) 24–28.
- [10] N.K. Aaronson, S. Ahmedzai, B. Bergman, M. Bullinger, A. Cull, N.J. Duez, A. Filiberti, H. Flechtner, S.B. Fleishman, J.C. de Haes, S. Kaasa, M.C. Klee, D. Osoba, D. Razavi, P.B. Rofe, S. Schraub, K.C.A. Sneeuw, M. Sullivan, F. Takeda, The European Organization for Research and Treatment of Cancer QLQ-C30; A quality-of-life instrument for use in international clinical trials in oncology, *J. Nat. Cancer Inst.* 85 (1993) 365–376.
- [11] Japanese Gastric Cancer Association, Japanese Classification of Gastric Carcinoma, 2nd English Edn, *Gastric Cancer* 1 (1998) 10–24.
- [12] K. Avery, J.M. Blazeby, Quality of life assessment in surgical oncology trials, *World J. Surg.* 30 (2006) 1163–1172.
- [13] C. Montesani, A. D'Amato, S. Santella, A. Pronio, C. Giovannini, M. Cristaldi, G. Ribotta, Billroth I versus Billroth II versus Roux-en-Y after subtotal gastrectomy. Prospective randomized study, *Hepatogastroenterology* 49 (2002) 1469–1473.
- [14] J.J. Xiong, K. Altaf, M.A. Javed, Q.M. Nunes, W. Huang, G. Mai, C.L. Tan, R. Mukherjee, R. Sutton, W.M. Hu, X.B. Liu, Roux-en-Y versus Billroth I reconstruction after distal gastrectomy for gastric cancer: A meta-analysis, *World J. Gastroenterol.* 19 (2013) 1124–1134.
- [15] T. Namikawa, H. Kitagawa, T. Okabayashi, T. Sugimoto, M. Kobayashi, K. Hanazaki, Roux-en-Y reconstruction is superior to Billroth I reconstruction in reducing reflux esophagitis after distal gastrectomy: special relationship with the angle of his, *World J. Surg.* 34 (2010) 1022–1027.
- [16] A.R. Kim, J. Cho, Y.J. Hsu, M.G. Choi, J.H. Noh, T.S. Sohn, J.M. Bae, Y.H. Yun, S. Kim, Changes of quality of life in gastric cancer patients after curative resection: a longitudinal cohort study in Korea, *Ann. Surg.* 256 (2012) 1008–1013.
- [17] C.W. Wu, M.C. Hsieh, S.S. Lo, W.Y. Lui, F.K. P'eng, Quality of life of patients with gastric adenocarcinoma after curative gastrectomy, *World J. Surg.* 21 (1997) 777–782.
- [18] D. Kobayashi, Y. Kodera, M. Fujiwara, M. Koike, G. Nakayama, A. Nakao, Assessment of quality of life after gastrectomy using EORTC QLQ-C30 and STO22, *World J. Surg.* 35 (2011) 357–364.
- [19] S.S. Lee, H.Y. Chung, W. Yu, Quality of Life of long-term survivors after distal subtotal gastrectomy, *Cancer Res. Treat.* 42 (2010) 130–134.