

ORIGINAL ARTICLE

Diagnostic value of multi-slice spiral CT (MSCT) combined with digestive tract angiography in gastric fundus cardia carcinoma

Jian Sun*, Yunhui Qu*, Na Long*, Chao Ran

Department of Medical Imaging, The Affiliated Yantai Yuhuangding Hospital of Qingdao University, Yantai264000, China

*These authors contributed equally to this work.

Summary

Purpose: To evaluate the diagnostic value of multi-slice spiral CT (MSCT) combined with digestive tract angiography in patients with gastric fundus cardia carcinoma.

Methods: A total of 185 patients with suspected gastric fundus cardia carcinoma admitted in our hospital were collected. Among them, 93 patients were examined with MSCT combined with digestive tract angiography and were enrolled in the research group. Another 92 patients examined by MSCT alone comprised the control group. The diagnostic value of MSCT combined with digestive tract angiography in patients with gastric fundus cardia carcinoma was investigated. 185 patients were diagnosed by pathological examination and 166 had gastric fundus cardia carcinoma, with 84 patients in the research group, and 84 patients in the control group. Fifty nine patients with gastric fundus cardia carcinoma in the control group were diagnosed by MSCT.

Results: There were significant differences compared with

pathological diagnosis ($p < 0.05$). Eighty-two patients with gastric fundus cardia carcinoma in the research group were diagnosed by MSCT combined with digestive tract angiography. There were no significant differences compared with pathological diagnosis ($p > 0.05$). Sensitivity, specificity and accuracy of the research group were significantly higher than those of the control group ($p < 0.05$). The detectable rate in imaging results of the research group was higher than that of the control group ($p < 0.05$).

Conclusions: MSCT combined with digestive tract angiography is more accurate than single MSCT in the diagnosis of gastric fundus cardia carcinoma, which can effectively reduce the misdiagnosis and missed diagnosis and is worthy of clinical promotion.

Key words: multi-slice spiral CT (MSCT), digestive tract angiography, gastric fundus cardia carcinoma, diagnostic value

Introduction

Although the incidence of gastric cancer has declined worldwide [1] in the past 100 years, it is still the second most common cancer and the third leading cause of cancer-related deaths. It accounts for about one-tenth [2] of new cancer cases in the world, and is also the third leading cause of cancer-related deaths worldwide [3]. While China's gastric cancer mortality rate has declined [4], it is still ranking second in the most common cancers

and the third in the most common causes of death caused by cancers [5]. Studies have shown that gastric cancer mostly occurs after long-term infection through Correa pathways, which can be gastritis, atrophy, intestinal metaplasia, dysplasia and cancers [6].

Gastric cancer is prone to be found in gastric fundus and cardia [7]. As a common malignant tumor of the digestive tract, gastric fundus cardia

Corresponding author: Chao Ran, MD. Department of Medical Imaging, Affiliated Yantai Yuhuangding Hospital of Qingdao University, No.20 Yuhuangding East Rd, Zhifu District, Yantai 264000, China.
Tel/Fax: + 86 535-6691999, Email: i7tajn@163.com
Received: 11/11/2020; Accepted: 18/12/2020

carcinoma has the characteristics of no trace of onset, high grade of malignancy and poor prognosis [8]. There are no typical clinical symptoms in patients with gastric fundus cardia carcinoma, and the location of gastric fundus and cardia is within the rib arch. So the risk of misdiagnosis and missed diagnosis is high [9]. Therefore, early detection and timely resection of gastric cancer are the key to improving the survival rate of patients [10]. It is a hot topic to increase the detectable rate of gastric fundus cardia carcinoma through specific imaging diagnosis. At present, with the improvement of people's living standards, MSCT has been widely used in clinical practice due to its simple operation, safety and non-invasive features [11]. Meanwhile, upper gastrointestinal barium meal examination is also a long-term diagnostic method in clinical practice [12].

This study explored the value of MSCT combined with digestive tract angiography in the diagnosis of gastric fundus cardia carcinoma by comparing the results of two groups of different examination methods and pathological examination results.

Methods

General data

185 patients with suspected gastric fundus cardia carcinoma admitted in our hospital were collected. Among them, 93 patients examined with MSCT combined with digestive tract angiography comprised the research group. There were 51 males and 42 females, with an average age of years (44.56 ± 7.32). Ninety two patients examined with MSCT comprised the control group, including 49 males and 43 females, with an average age of years (44.78 ± 6.97).

Inclusion criteria: patients who were accompanied by family members on admission; patients examined with MSCT or digestive tract examination; patients diagnosed as suspected gastric fundus cardia carcinoma, with complete clinical data. Exclusion criteria: patients who had previous history of mental illness and a family history of mental illness, history of autoimmune system defects, history of combined metabolic disease or history of drug dependence; patients who could not cooperate with the examination due to aphasia, irritability, unclear consciousness and communication disorders.

This study was approved by the ethics committee of our hospital. All the specific experimental content was presented to the patient and his/her family in advance. All participants have agreed and signed informed consent.

Methods

The patients in the control group were examined with MSCT. After fasting for 6 h, they were prescanned with MSCT. After drinking 1000ml of water, the patients stayed in supine position until the thickness of the gastric wall was even and the gastric mucosa formed a small jagged shape. When scanning formally, the patients were asked to hold the breath until the scan was completed. The patients were scanned for 10 s at a speed of 0.5 s/circle and processed after obtaining images. Patients in the research group underwent MSCT combined with digestive tract angiography. The examination with MSCT was the same as before. In the digestive tract angiography examination, patients were fasted and water-deprived for 6 h. Then they were given oral gas powder with 50 ml of barium sulfate suspension contrast agent. Gastrointestinal radiography machine was used to see the chest and abdomen from multiple angles, to observe the lesions. Film was spotted at 70 kV and 80mAs.

Observation indexes

The results of pathological diagnosis were recorded and compared with the results of the control and the

Table 1. Comparison of general data in the two groups

	Research group (n=93)	Control group (n=92)	t / χ^2	p
Age (years)	44.56 \pm 7.32	44.78 \pm 6.97	0.21	0.83
BMI (kg/m ²)	20.64 \pm 3.67	20.59 \pm 3.71	0.09	0.93
Gender, n (%)			0.05	0.83
Male	51 (54.84)	49 (53.26)	-	-
Female	42 (45.16)	43 (46.74)	-	-
History of smoking, n (%)			0.13	0.72
Yes	56 (60.22)	53 (57.61)	-	-
No	37 (39.78)	39 (42.39)	-	-
Average duration (years)	2.54 \pm 0.61	2.49 \pm 0.59	0.57	0.57
Clinical symptoms, n (%)			-	-
Melena	16 (17.20)	15 (16.30)	0.03	0.87
Swallowing Discomfort	28 (30.11)	30 (32.61)	0.13	0.71
Vomiting	29 (31.18)	28 (30.43)	0.01	0.91
Retrosternal discomfort	20 (21.51)	19 (20.65)	0.02	0.89

research group. The misdiagnosis rate, missed diagnosis rate, sensitivity, specificity and accuracy of the two groups were calculated. The detection rate of various imaging manifestations in the two groups was recorded.

Statistics

In this study, SPSS 20.0 (IBM Corp., Armonk, NY, USA) was used for statistical analyses. GraphPad Prism 7 (San Diego GraphPad Software Ltd., USA) was used for graphics. [n(%)] was used to count the data and χ^2 test was used for the comparison between groups. Mean \pm SD was used for measuring the data. T test was used to compare the two groups. $P < 0.05$ was considered statistically significant.

Results

Comparison of general data

General data of the two groups of patients were collected, as shown in Table 1. There was no significant difference in age, mean course of disease, smoking history and clinical symptoms between the two groups ($p > 0.05$).

Pathological examination results

There were a total of 185 patients with suspected gastric fundus cardia carcinoma in the two groups. Among them, 166 patients (89.73%) were diagnosed as gastric fundus cardia carcinoma after pathological diagnosis. Among the 93 patients in the research group, there were 84 patients (90.32%) diagnosed as gastric fundus cardia carcinoma after pathological diagnosis. Among the 92 patients in the control group, there were 82 patients (89.13%) diagnosed as gastric fundus cardia carcinoma after pathological diagnosis, as shown in Figure 1.

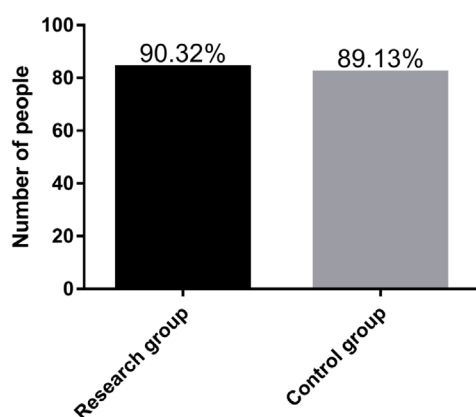


Figure 1. Pathological diagnosis of patients in the two groups. After pathological diagnosis, there were 84 patients diagnosed with gastric fundus cardia carcinoma in the research group, and 82 patients diagnosed with gastric fundus cardia carcinoma in the control group. The results showed that the difference was not statistically significant ($p > 0.05$).

Comparison of examination results and pathological examination results of the control group

In the control group, the results of MSCT examination and the results of pathological examination were compared, as shown in Figure 2. There were 59 patients diagnosed as gastric fundus cardia carcinoma with MSCT, including 33 negative patients, with significant difference from pathological examination results ($p > 0.05$).

Comparison of examination results and pathological examination results of the research group

In the research group, the results of MSCT combined with digestive tract angiography and the results of pathological examination were compared, as shown in Figure 3. By MSCT combined with digestive tract angiography, there were 82 patients diagnosed as gastric fundus cardia carcinoma, including 11 negative patients, without significant difference from the results of pathological examination ($p > 0.05$).

Comparison of misdiagnosis rate and missed diagnosis rate between the two groups

The misdiagnosis rate of the research group (0.00%) was significantly lower than that in the control group (20.00%) ($p < 0.05$). The missed diagnosis rate in the research group (2.38%) was significantly lower than that in the control group (30.49%) ($p < 0.05$), as shown in Figure 4.

Comparison of sensitivity, specificity and accuracy between the two groups

The sensitivity, specificity and accuracy between the two groups were compared, as shown

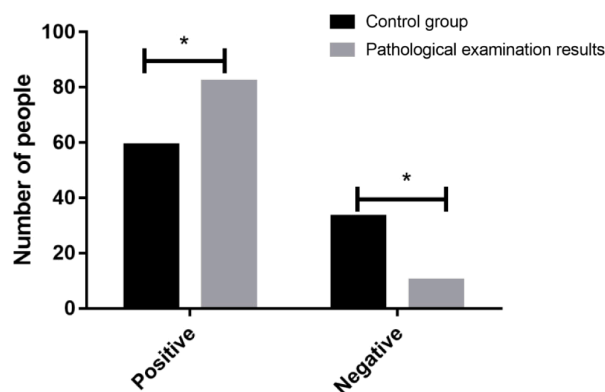


Figure 2. Comparison of examination results of MSCT combined with digestive tract radiography and pathological diagnosis of the control group. There was significant difference between positive diagnosis and pathological diagnosis, negative diagnosis and pathological diagnosis in the control group. *indicates $p < 0.05$ compared to pathological diagnosis.

in Figure 5. The sensitivity of the research group (97.62%) was significantly higher than that in the control group (69.51%) ($p < 0.05$). The specificity of the research group (100.00%) was significantly higher than that in the control group (80.00%) ($p < 0.05$). The accuracy of the research group

(97.85%) was significantly higher than that in the control group (70.65%) ($p < 0.05$).

Comparison of detection rates of image performance in the two groups

The detection rates of image performance in the two groups were compared, as shown in Table 2. The detectable rate of malignant niches, mucosal lesions, soft tissue masses, gastric wall thickening and esophageal stenosis in the research group was higher than that in the control group ($P < 0.05$).

Discussion

Gastric fundus cardia carcinoma is a malignant tumor 2.0-2.5 cm from the cardia [13], which can be treated mainly with surgery. The outcome and prognosis of patients after surgery are closely related to their early diagnosis [10]. Hence, the key to treating the patients with gastric fundus cardia carcinoma lies in the simple and accurate examination method for diagnosis [14]. At present, the main diagnostic methods of gastric fundus cardia carcinoma are clinically digestive tract angiography and MSCT [15,16].

In this study, among 185 patients with suspected gastric fundus cardia carcinoma, there were 166 (89.73%) patients diagnosed as gastric fundus car-

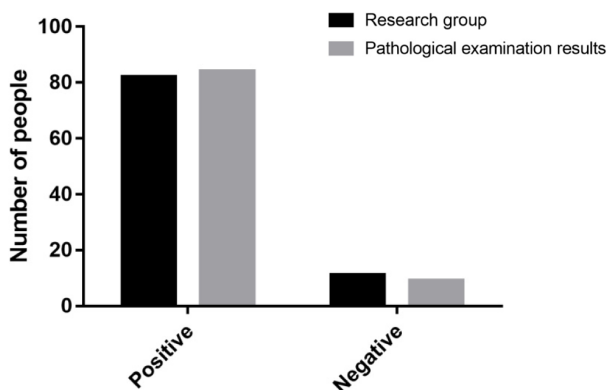


Figure 3. Comparison of examination results of MSCT combined with digestive tract radiography and pathological diagnosis of the research group. There was no significant difference between positive diagnosis and pathological diagnosis in the research group, and there was no significant difference between negative diagnosis and pathological diagnosis in the research group. The Figure shows great difference ($p > 0.05$).

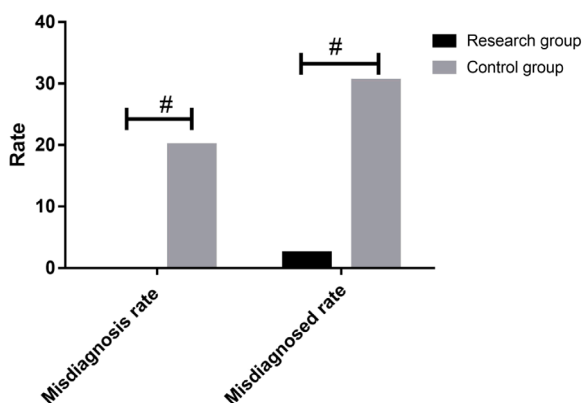


Figure 4. Comparison of misdiagnosis and missed diagnosis rate between the two groups. The misdiagnosis rate and missed diagnosis rate of the research group were significantly lower than those in the control group. # indicates $p < 0.05$ compared with the control group.

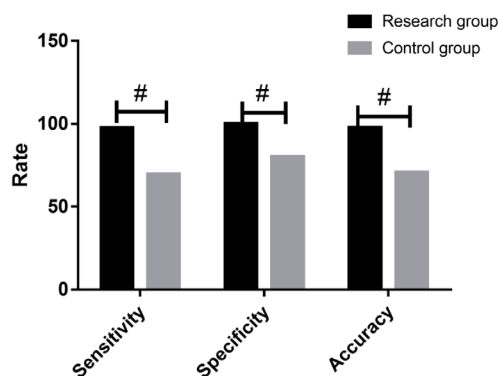


Figure 5. Comparison of sensitivity, specificity and accuracy of different examination methods between the two groups. The sensitivity, specificity and accuracy of the research group were significantly higher than those in the control group. # indicates $p < 0.05$ compared with the control group.

Table 2. Comparison of imaging results between two groups

	Malignant niche	Mucosal lesions	Soft tissue mass	Thickening of gastric wall	Lower esophageal stenosis
Research group (n=84), n (%)	83 (98.81)	82 (97.62)	80 (95.24)	83 (98.81)	79 (94.05)
Control group (n=82), n (%)	26 (31.71)	40 (48.78)	36 (43.90)	64 (78.05)	56 (68.29)
χ^2	82.87	50.81	51.59	17.64	18.12
P	0.00	0.00	0.00	0.00	0.00

dia carcinoma by pathological examination. There were 84 patients with gastric fundus cardia carcinoma among 93 patients in the research group, and 82 among 92 patients in the control group. A total of 59 patients with gastric fundus cardia carcinoma were diagnosed by MSCT in the control group, with significant differences from pathological examination results. MSCT enables doctors to observe the lesion from multiple perspectives and visually see the growth of the tumor in the lumen, wall and outside of the lumen and the metastasis invading the surrounding organs of the patients [17]. It has high speed, high quality, low radiation dose and other characters [18], with advantages in judging the cancer site of patients and is conducive to the development of reasonable treatment plans for patients. However, the gastrointestinal peristalsis and mucosal lesions cannot be observed by MSCT [19]. In addition, there were no obvious thickening or even no thickening of the gastric wall in some patients with early gastric fundus

cardia carcinoma. Some healthy people might have local thickening of the gastric wall. As a result [20], the diagnostic effect of MSCT in early gastric cancer was not ideal. So, digestive tract angiography was used in this study combined with MSCT to diagnose gastric fundus cardia carcinoma. Digestive tract angiography has the advantages of convenient operation and wide range of application [21], with positive significance in the diagnosis of early mucosal lesions and soft tissue masses in patients. But it is poor to test whether the inner and outer tissues of the stomach wall have been invaded by a tumor [22]. This study used MSCT combined with digestive tract angiography to make up the shortcomings for each other, to improve the diagnostic accuracy of patients with gastric fundus cardia carcinoma. During this study, there were 82 patients with gastric fundus cardia carcinoma diagnosed by MSCT combined with digestive tract angiography. There was no significant difference compared with the results of pathological examination. Furthermore, the misdiagnosis rate and missed diagnosis rate of the research group were significantly lower than that of the control group. The sensitivity, specificity and accuracy of the control group in the diagnosis with MSCT were 69.51%, 80.00% and 70.65%, respectively. The sensitivity, specificity and accuracy of research group in the diagnosis with MSCT combined with digestive tract angiography were 97.62%, 100.00% and 97.85%, respectively, which were significantly higher than in the control group. It indicated that MSCT combined with digestive tract angiography is more accurate than MSCT alone. Mucosal lesions and soft tissue masses are important imaging features of gastric fundus cardia carcinoma [23]. All the imaging re-

sults in the research group were higher than those in the control group. This is probably one reason why MSCT combined with digestive tract angiography can improve the diagnostic accuracy of patients with gastric fundus cardia carcinoma.

In this study, the results of the control and research group were compared with pathological examination results. The misdiagnosis rate, missed diagnosis rate and sensitivity, specificity and accuracy of the two groups were counted according to the comparison between the results of the control and study group with the results of pathological examination. The detectable rates of various imaging results of the two groups were recorded. The diagnostic value of MSCT combined with digestive tract angiography in patients with gastric fundus cardia carcinoma were investigated. The results showed that 59 patients in the control group were diagnosed with gastric fundus cardia carcinoma by multi-slice spiral CT, which was significantly different from the pathological diagnosis ($p < 0.05$). There were 82 patients diagnosed as gastric fundus cardia carcinoma by multi-slice spiral CT combined with gastrointestinal angiography in the study group, which was not significantly different from the pathological diagnosis ($p > 0.05$). The misdiagnosis rate and missed diagnosis rate in the study group were significantly lower than those in the control group ($p < 0.05$). The sensitivity, specificity and accuracy were significantly in the study group than those in the control group ($p < 0.05$). The detection rate of imaging manifestations in the study group was higher than that in the control group ($p < 0.05$). However, due to the small number of patients selected in this study, some limitations still exist. We will continue to improve the research in the future to provide more scientific reference for clinical treatment, in order to better improve the prognosis of patients.

To sum up, MSCT combined with digestive tract angiography is obviously more accurate than MSCT alone in the diagnosis of gastric fundus cardia carcinoma. The combined detection can effectively reduce the misdiagnosis and missed diagnosis rate, and is worthy of clinical promotion.

Authors' contributions

RC and XX conceived and designed the study and drafted the manuscript. RC, HZ, HM and XX collected, analyzed and interpreted the experimental data. RC and HZ revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

Conflict of interests

The authors declare no conflict of interests.

References

- Kinoshita H, Hayakawa Y, Koike K. Metaplasia in the Stomach-Precursor of Gastric Cancer? *Int J Mol Sci* 2017; 18:2063.
- Cainap C, Vlad C, Seicean A et al. Gastric cancer: adjuvant chemotherapy versus chemoradiation. A clinical point of view. *JBUON* 2019; 24:2209-19.
- Huang H, Tian J, Xu X et al. A study on the roles of *Helicobacter pylori* in bile reflux gastritis and gastric cancer. *JBUON* 2018; 23:659-64.
- Gao K, Wu J. National trend of gastric cancer mortality in China (2003-2015): a population-based study. *Cancer Commun (Lond)* 2019;39:24.
- Wang SM, Zheng RS, Zhang SW et al. [Epidemiological characteristics of gastric cancer in China, 2015]. *Zhonghua Liu Xing Bing Xue Za Zhi* 2019; 40:1517-21.
- Yu G, Torres J, Hu N et al. Molecular Characterization of the Human Stomach Microbiota in Gastric Cancer Patients. *Front Cell Infect Microbiol* 2017; 7:302.
- Peng JJ, Xiao P, Xu JB, Song W, Liao B, He YL. Clinicopathological features and trend changes of gastric carcinoma in Southern China. *World J Gastroenterol* 2014; 20:4401-6.
- Chen S, Song L, Xie X, Han X, Cheng B. A case of abdominal mesenteric Castleman's disease with left renal cell carcinoma and stomach leiomyoma. *Hell J Nucl Med* 2016; 19:285-8.
- Koprucu S, Yaman M. Histological and histochemical characterization of the digestive tract of European catfish (*Silurus glanis* Linnaeus, 1758). *Cell Mol Biol (Noisy-le-grand)* 2016; 62:1-5.
- Huang Q, Li R, Xu GF, Zhou D, Fan XS, Zou XP. Emerging evidence supports grouping by location of early gastric carcinoma for appropriate clinical management in Chinese patients. *J Dig Dis* 2018; 19:730-6.
- Yu J, Zhu S, Ge Z et al. Multislice spiral computed tomography in the differential diagnosis of ground-glass opacity. *J Cancer Res Ther* 2018; 14:128-32.
- Ngaile JE, Msaki PK, Kazema RR, Schreiner LJ. Initial Investigation of Factors Influencing Radiation Dose to Patients Undergoing Barium-Based Fluoroscopy Procedures in Tanzania. *Radiat Prot Dosimetry* 2017; 174:262-74.
- Bano K, Al-Shoha M, Raghavapuram S et al. Gastric Cardia Cancer Masquerading as a Fundic Subepithelial Tumor. *Am J Gastroenterol* 2018; 113:1428.
- Meng Y, Zhang J, Wang H et al. Poorer prognosis in patients with advanced gastric squamous cell carcinoma compared with adenocarcinoma of the stomach: Case report. *Medicine (Baltimore)* 2017; 96:e9224.
- Xu Y, Xiang M, Cheng F et al. [Application of multi-slice spiral CT to assess vascular volume for the diagnosis and treatment of gastric varices]. *Zhonghua Gan Zang Bing Za Zhi* 2019; 27:128-32.
- Varni JW, Shulman RJ, Self MM et al. Perceived medication adherence barriers mediating effects between gastrointestinal symptoms and health-related quality of life in pediatric inflammatory bowel disease. *Qual Life Res* 2018; 27:195-204.
- He B, Yang J, Xiao J et al. Diagnosis of lower gastrointestinal bleeding by multi-slice CT angiography: A meta-analysis. *Eur J Radiol* 2017; 93:40-45.
- Li CF, Wang DP, Xue YW. Evaluation of a multi-slice spiral computed tomography perfusion for the prediction of the recurrence of gastric cancer. *Fut Oncol* 2018; 14:1953-63.
- Winklhofer S, Lambert JW, Wang ZJ et al. Reduction of peristalsis-related gastrointestinal streak artifacts with dual-energy CT: a patient and phantom study. *Abdom Radiol (NY)* 2016; 41:1456-65.
- Kim DJ, Kim W. Inflammatory myofibroblastic tumor treated with laparoscopic proximal gastrectomy and double-tract anastomosis. *J Gastric Cancer* 2015; 15:64-7.
- Zyluk A, Jagielski W, Janowski P. [A multilevel obstruction of the digestive tract in a young female patient soon after delivery: a case report]. *Pomeranian J Life Sci* 2016; 62:60-3.
- Takeuchi C, Yamamichi N, Shimamoto T, Takahashi Y, Mitsushima T, Koike K. Gastric polyps diagnosed by double-contrast upper gastrointestinal barium X-ray radiography mostly arise from the *Helicobacter pylori*-negative stomach with low risk of gastric cancer in Japan. *Gastric Cancer* 2017; 20:314-21.
- Mino JS, Guerron AD, Monteiro R et al. Long-term outcomes of combined endoscopic/laparoscopic intragastric enucleation of presumed gastric stromal tumors. *Surg Endosc* 2016; 30:1747-53.