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Hiatal Hernia in a Japanese Population ABCC, Hiroshima

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日本人における食道裂孔ヘルニア

小　暮　　喬, Walter J. Russell, 立　川　　清

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要　約

「前期」および「後期」調査において行なつた上部胃腸X線検査によつて診断された食道裂孔ヘルニアの症例を検討した．「前期」調査においては 0.6%の有病率を認め，「後期」調査では 2.3%であつた．この差異は統計学的に有意であり，それは検査技法の違いによるものと考えられる．本研究において食道裂孔ヘルニアと明らかに関係をもつ唯一の因子は患者の年令であつた．また本研究の「後期」調査において，食道粘膜脱出5例を発見した．

Background

The prevalence of hiatal hernia has been variously reported, as high as 67% in the English literature[1]. Prior to 1925, the condition was rarely reported; in that year Morrison[2] pointed out that it was probably being overlooked and that greater effort should be exerted to detect it during upper gastrointestinal tract examinations. He reported a prevalence of 1.2%, but later reports in the English literature indicate

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it to be approximately 4–5%[3].

In the Japanese literature, fewer series and case reports are available. This suggests that the prevalence of hiatal hernia is generally lower than in other countries, except in the series reported by Nozaki[4], where it was 13%. Table 1a and 1b show all series and cases in the Japanese literature to date, the prevalence for some of these series, with the number and type of herniation at the esophageal hiatus. In Japan, the sliding-type hernia is generally considered to be the most frequent, as it is in the Western countries, though Abowitz[5] reported the paraesophageal type to be more frequent in his series. At least 6 of the 41 cases reported by Tsuneoka[6] were of the paraesophageal type, but all patients in his series were over 60 years of age and confined to a home for the aged.

Table 1a. Hiatal hernia; reported cases in Japanese literature including types of hiatal hernia

Investigator	Year	Short esophagus	Para-esophageal	Sliding	Paraesophageal plus sliding ?	Short esophagus or paraesophageal
Koikegami[42]	1933	1	—	—	—	—
Makidono[43]	1937	1	—	—	—	—
Furukawa[44]	1940	1	—	—	—	—
H. Nozaki[45]	1953	1	—	—	—	—
Kondo[46]	1956	—	—	—	1	—
Kurokawa[47]	1957	1	2	2	—	—
Kimura[48]	1960	—	—	—	—	1
Maki[49]	1960	—	—	—	—	5
Otomo[50]	1960	—	—	—	1	—
Ozawa[51]	1960	1	—	—	—	—
Arakawa[52]	1961	1	—	—	—	—
J. Nozaki[53]	1961	—	—	—	—	2
Sawada[54]	1961	—	—	—	1	—
Uda[55]	1961	1	1	1	—	—
Y. Nozaki[56]	1963	—	1	—	—	—
Total		8	4	3	3	8

Table Ib. Hiatal hernia; reported series in Japanese literature including prevalence of hiatal hernia and types of hiatal hernia

Investigator	Year	Prevalence (%)	Number examined	Short esophagus	Paraesophageal	Sliding	Paraesophageal plus sliding ?	Shorte sophagus or paeaesophageal
Kase[41]	1960	0.16	8585	3	1	10	—	—
Tsuneoka*[6]	1961	2	1873	—	6	27	8	—
Yuki[57]	1961	3	134	—	1	3	—	—
Y. Nozaki[4]	1963	13.3	164	—	—	22	—	—
Total		...	...	3	8	62	8	—

* All cases over 60 years.

It is well known that hiatal hernia detection rates vary with the fluoroscopic technique. Most examiners agree that placing the patient in the recumbent and Trendelenburg positions enhances the ability to detect the abnormality, as compared to the erect position[3,7~9], especially when respiratory maneuvers are employed and intra-abdominal pressure is increased. Some invesitgators have found that

the use of mechanical devices[10] and additional special positions[11] results in the detection of more hernias.

Age and the atrophy of tissue, notably about the phreno-esophageal membrane, and constipation, pregnancy, flatus, obesity, and trauma have all been implicated as possible etiologic factors in the development of the acquired type of diaphragmatic hernia[12,13]. Some investigators have reported that a pathological relationship between intestinal diverticulosis and diaphragmatic hernia may exist[13]. Friedman states hiatal hernia occurs in cases of carcinoma of the gastric cardia[14], but that hernias develop secondary to the neoplasms.

Though occasional series are reported with an apparently good correlation of symptoms to hiatal hernia, or in which the symptoms appear to be pathognomonic[15] of the condition, correlation betweeen these symptoms and the abnormality is generally poor[13,16,17]. The size of the hiatal hernia generally is reported not to correlate well with symptoms, but Hafter[15] reported good correlation. Symptoms are generally attributed to a reflux esophagitis, gastritis, and ulceration in the herniatedsasstric segment, whicb is difficult to detect and frequency overlooked[18-20]. Hiebert[21] has shown that gastric cardia incompetency can exist without hiatal hernia and can cause inflammatory changes in the distal portion of the esophagus due to gastric reflux.

In recent years the anatomical and physiological aspects of the distal portion of the esophagus and its interrelationship with the gastric cardia have received much attention, in efforts to make the esophagogastric junction more readily identifiable, and thereby permit easier identification of the sliding type of hiatal hernia. The imporgtance of documenting fluoroscopic findings roentgenographically has been stressed[22].

Detailed studies have attempted to identify the mucosal junction and certain structures of the lower esophagus and stomach in the esophageal hiatus region.[1,16,23-30] Templeton[31] has pointed out that, despite thd many attempts to clarify the anatomical and physiological aspects, considerable confusion still exists, that many of the hernias reported are not truly hernias, but "phrenic ampullae," and that the two are distinguishable.

A condition occasionally associated with sliding-type hiatal hernia is "mucosal invagination" at the level of the lower portion of the esophagus or esophagogastric junction[32-35]. This has also been referred to as "transmigration of mucosa," "gastroesophageal invagination," "invagination of esophagus," "cardioesophageal intussusception," "extrusion or prolapse of gastric mucosa into the esophagus."[35] According to Klinefelter,[32] this condition often responds to medical therapy with resolution of symptoms. One case of frank obstruction of the esophagus by migrating gastric mucosa has been reported[36]. No cases are recorded in the Japanese literature. Five identified in this series have been reported[37].

Present Study

In the present study, hiatal hernias were classified as (1) siding, by slize, (2) paraesophageal, and (3) So-called " short esoghagus " type. The "retrospective" portion of this study was a review of all roentgenograms and fluoroscopy reports of patients with diaphragmatic hernia, in a series of 5013 consecutive examinations of upper gastrointestinal tracts. Whether the recumbent or Trendelenburg positions and respiratory maneuvers were used in all examinations of the esophagus and stomach is not known. All cases of hiatal hernia were classified by type and all medical records were reviewed for correlation of symp-

toms and other disease.

The "prospective" portion of the study consisted of review of roentgenological reports, roentgenograms of the upper gastrointestinal series and the medical records of all hiatal hernia cases diagnosed from February 1963 to February 1964 in 479 consecutive upper gastroinestinal series. Some repeat examinations were made, but excluded in calculating hiatal hernia rates.

In the "prospectve" portion of the study, our routine procedure for the examination of the upper gastrointestinal tract consisted first of observation of the esophagus and gastric cardia in the right anterior oblique and posteroanterior projections using a thin barium mixture. Following this, the stomach and duodenum were examined in the erect and then the recumbent positions with air-contrast views. The esophagus and gastric cardia were then re-examined in the supine and prone positions, employing Valsalva and Mueller maneuvers, using first a thin and then a thick barium mixture. In the majority of ycases the Trendelenburg position was also used. Spot films of all esophagogastric regions were obtained.

Small sliding-tpyle hiatal hernias are frequently difficult to delineate roentgenologically, primaril because of mobility of the structures involved and lack of fixed landmarks[38]. In a minority of cases in this study an abrupt junction between esophageal and gastric mucosa was identified. Identification of this junction or identification of gastric mucosal folds above the hiatus region or both were the sole criteria used for establishing the presence of small sliding-type hiatal hernias. In the absence of these criteria, reflux of barium into the esophagus and widening or relaxation of the hiatus region alone were not considered evidence for herniation. Dilated phrenic ampullae and all cases of esophageal mucosal prolapse or transmigration were excluded[37]. No contractile (Schatzki) rings were encountered in this study. In each case of hernia, fluoroscopic findings were verified by at least two spot films.

Results

Retrospective Study

The "retrospective" study results are shown in Table 2, where the hernias detected are classified by type, sex, and age. The hernia size, weight and height of the patient, and information concerning pregnancy and childbirth are also given. A total of 32 hiatal hernias was found; a prevalence of 0.6%. There were 24 sliding type, 6 paraesophageal type, and 2 of the short esophagus type. Two of the 6 paraesophageal cases were initially detected by roentgenographic examination of the chest.

The youngest patient in the group with sliding-type hernias was 35 years; the oldest, 83 years. The mean age in this group was 61 years.

The sliding hernias varied in size from approximately 1.5 cm to 7.5 cm in greatest diemension. Of all hernias in persons over 60 years of age, 7.5 cm was the greatest dimension.

All females ha ing sliding-type hernias had a history of childbirth, excepting 1 case, for whom an obstetricalhistory was not obtainable. Some relation with childbirth was therefore suggested, but age-specific comparisons with females who had not borne children was not possible. The height and weight of the hiatal hernia patients were found to be within two standard deviations from the average height and weight in Japan[39]. Therefore, sliding-type hernia did not corelate with the height or weight of the patient.

All of the paraesophageal-type hernias were in females. The youngest was 68 years of age; the oldest, 82 years. In the 2 cases diagnosed only by chest roentgenography, no obstestrical histories were available,

Table 2. Retrospective study, ABCC; hiatal hernias, by age, sex, childbirth, body weight and height, and size of hernia

Retrospective study (Total number examined 5,013)

	Total	Sliding	Paraesophageal	Short esophagus
Female	15	8	6	1
Male	17	16	—	1
Both sexes.....	32	24	6	2

Age	Sex	No. child		Fetal deaths		Patient		Hernia size		
		Total	Alive	Abortion	Still-births	Weight-kg	Height-cm	Height	Width	Width-center
Sliding										
48	F	4	4	—	—	39.5	145.1	2.0	1.0	.....
50	F	5	5	3	—	50.8	154.9	2.0	2.5	.....
53	F	8	7	—	—	51.7	140.0	1.5	1.5	.....
67	F	No history				38.0	139.0	4.5	2.0	3.5
71	F	6	3	—	—	55.2	155.5	4.0	1.5	.....
76	F	3	3	—	—	40.0	131.6	3.0	1.5	.....
80	F	1	1	—	—	42.0	139.2	7.5	3.5	5.0
83	F	6	1	1	—	35.5	142.0	3.5	4.0	.....
35	M					49.6	167.2	1.5	1.5	.....
48	M					72.5	161.9	4.5	2.5	.....
54	M					64.7	166.6	4.0	4.0	.....
55	M					57.0	160.5	3.0	2.0	.....
58	M					43.8	156.8	3.0	4.0	.....
58	M					52.2	159.8	3.0	2.5	.....
59	M					37.2	149.9	3.5	2.5	.....
60	M					57.1	158.2	3.0	2.0	.....
60	M					60.4	154.6	1.5	2.0	.....
61	M					80.8	167.2	3.0	2.5	.....
62	M					47.8	153.0	6.0	5.0	.....
63	M					57.1	160.1	4.0	5.0	.....
64	M					49.6	157.0	2.0	2.5	.....
65	M					63.9	168.6	4.0	1.5	2.0
69	M					44.1	152.2	2.0	1.5	.....
82	M					42.0	150.5	1.5	1.0	.....
Paraesophageal										
68	F	5	4	1	—	30.3	142.0	3.5	4.5	.....
76	F	6	2	—	—	46.4	143.4	5.4	4.5	.....
78	F	10	5	—	—	33.9	130	5.5	2.5	5.5
82	F	10	6	1	—	46.4	138.2	7.6		10.0
Chest X-ray only										
74	F	No history				42.4	141.0	.....	.....	.....
75	F	No history				50.3	138.2	.....	.....	.....
Short esophagus										
		Symptoms		Secondary Changes						
44 mo.	F	Vomiting		Esophagitis with 3mm ulcer				4.0	1.5	.....
8 mo.	M	Vomiting		Esophagitis				3.0	2.0	4.0

but the other 4 patients had all borne at least 5 children; 2 had borne 10. The paraesophageal hernias measured from 2.5 cm to 10.0 cm in greatest dimension; the 2 diagnosed by chest roentgenograms were not measured, but were moderately large.

One of the short esophagus-type hernias occurred in a male of 8 months; the other, in a female of 44 months. The roentgenograms showed signs of esophagitis in the distal end of the short esophagus in both cases, with ulceration in the female. No esophagitis nor ulceration was detected in any of the paraesophageal or sliding hernias.

Prospective Study

The hernias detected in the "prospective" study are classified by type, by sex, and according to age in Table 3. The hernia size, height and weight of the patient, and information concerning pregnancy and childbirth are also given. In this series of 479 consecutive upper gastrointestinal examinations, 11 (2.3%) hiatal hernias were detected; 9 of the sliding type; 2 of the paresophageal type. None of the short esophagus type was found.

The youngest patient with sliding-type hernia was 39 and the oldest, 72 years. The 2 patients with paraesophageal hernias were females of 64 and 69 years age.

The "prospective" study had relatively fewer patients than the "retrospective" one, but only 3 of the 9 cases of sliding hernias were in females, a ratio similar to that of the "retrospective" study. Two of the

Table 3. Prospective study, ABCC; hiatal hernias, by age, sex, childbirth, body weight and height, and size of hernia

Prospective study (Total number examined 479)

	Total	Sliding	Parasophageal
Female	5	3	2
Male	6	6	0
Both sexes	11	9	2

Age	Sex	No. child		Fetal deaths		Patient		Hernia size	
		Total	Alive	Abortion	Stillbirths	Weight-kg	Height-cm	Height	Width
Sliding									
41	F	1	1	—	1	38.0	140.2	1.5	2.0
64	F	No chart available				.....	.....	2.0	2.0
72	F	6	6	—	1	39.8	151.8	2.0	1.5
39	M					61.0	163.0	3.0	2.0
51	M					59.6	158.6	1.5	1.5
57	M					50.6	153.8	3.0	1.5
66	M					48.0	158.4	3.0	2.0
69	M					56.7	156.0	3.0	2.5
71	M	No chart available						3.0	4.5
Paraesophageal									
64*	F	3	2	—	1	35.2	134.6	6.5	5.5
69*	F	3	3	—	—	41.0	141.0	5.5	3.0

* Initial diagnosis by chest examination; confirmed by upper gastrointestinal study.

3 females with sliding-type hernias had borne children; no obstetrical history was available for the third one. Each of the 2 females with paraesophageal hernias had borne 3 children.

The sliding-type hernias ranged from 1.5 cm to 4.5 cm in greatest dimension, but although suggestive, a correlation between hernia size and age was not demonstrated. The 2 paraesophageal hernias measured 5.5. cm and 6.5 cm in greatest dimension in the "prospective" study and though both were initially detected on chest roentgenograms, dimensions were based on the upper gastrointestinal examination findings.

Retrospective and Prospective Studies

Symptom Correlation

Review of the patient s' medical records revealed symptoms and signs as shown in Table 4 forthe "retrosepective" and "prospective"studies. These are classified by hernia type. Epigastric pain and heartburn were the most predominant symptoms in the "retrospective" study. The symptoms and signs in the "prospective" study patients showed no such predominance, but the number of patients was relatively few. Though these symptoms and signs could have been due to other pathology in the gastrointestinal tract, they may well be ascribed to the hiatal hernias.

Table 4. Symptoms and signs ; prospective study and retrospective study, ABCC

	Retrospective	Prospective
Total number examined	5013	479
Type: Sliding		
Epigastric pain	7	1*
Asymptomatic	5	—
Positive occult blood, symptomatic	7	1
Positive occult blood, asymptomatic	2	4
Heartburn	3	—
Pressure feeling or obstructive feeling	2	2
Anorexia	2	1
Vomiting	1	—
Nausea	1	—
Weight loss	1	—
Right lower quadrant pain	1	—
Belching (for 3 months)	—	1
Type: Paraesophageal		
Asymptomatic	4	—
Heartburn	2	—
Hematemesis	1	—
Vomiting	1	—
Nausea	1	—
Anorexia	1	1
General malaise	1	1
Weight loss	—	1
Positive occult blood, asymptomatic	1	1
Positive occult blood, symptomatic	0	0

* Hernia, paraumbilical.

Table 5. Other diagnosed disease;retrospective and prospective study, ABCC

	Retrospective	Prospective
Total number examined	5013	479
Type: Sliding		
Gastrosintestinal		
Duodenal diverticulum	3	
Hepatomegaly, jaundice	3	
Gastric ulcer	2	
Duodenal ulcer	1	1
Gastric polyp (malignant), antrum	1	
Cirrhosis of liver	1	
Pulmonary		
Pulmonary emphysema	5	1
Pulmonary tuberculosis, active	4	1
Pulmonary tuberculosis, inactive	1	1
Pleural adhesion	1	
Cardiovascular		
Hypertension	6	
Anemia	4	2
Cerebral hemorrhage	1	
Skeletal		
Kyphosis	6	
Scoliosis	1	1
Endocrine system		
Diabetes mellitus	2	
Pancreatic carcinoma	1	
Hyperthyroidism	1	
Other diagnosed disease	2	3
Type: Paraesophageal		
Gastrointestinal		
Duodenal diverticulum		2
Pulmonary		
Pulmonary emphysema	2	1
Pulmonary tuberculosis	1	
Cardiovascular		
Hypertension	2	
Aneurysm, thoracic aorta	1	
Skeletal		
Kyphosis	7	2
Asymmetrical rib cage	1	
Scoliosis	1	

Obstructive feeling may have a pathognomonic value; 22.2% of hiatal hernia patients in the "prospective" study had obstructive feeling while only 2.3% of non-hernia patients had that feeling. This difference is statistically sisnificant at the 5% level. Of hiatal hernia patients 11.1% had epigastric pain while 38.9% of non-hernia patients had epigastric pain. This difference is not statistically significant. Of hiatal hernia patients 55.6% had occult blood in the stool while 31.9% of non-hernia patients had occult bleeding. This difference is not statistically significant. "Classical" symptoms of hiatal hernia, such as aggravation in the recumbent position, were not encountered.

Other Diagnosed Disease

Table 5 shows the prevalence of other diagnosed disease in cases of hiatal hernia. All paraesophageal hernia cases in both studies had kyphosis of the thoracic spine, suggesting that such skeletal deformity may contribute to the formation of hiatal hernias.

In the "prospective" study 22.2% of hiatal hernia patients had duodenal diverticula and 6.6% of non-hernia patients had duodenal diverticula. This difference, however, is not statistically significant and concomitance of hiatal hernia and duodenal diverticulum was not demonstrated. As for anemia, there is no significant aifference between hiatal hernia patients (22.2%) and non-hernia patients (11.1%). The present examinations demonstrated no other gastrointestinal abnormalities,such as diverticulosis of the colon or gastric carcinoma, which might be related to hiatal hernia. No relationship between hiatal hernia and other diagnosed disease could be demonstrated.

Correlation with Sex

In both the "retrospective" and "prospective" studies, there was a definite correlation of prevalence with sex. Of the 33 total sliding-type hernias detected, 24 were found in the "retrospective" study; 9, in the "prospective" study. Twenty-two of the 33 sliding-type hernias cocurred in males; 16, in the "retrospective"; 6, in the "prospective" study. A total of 11 sliding-type hernias were detected in females; 8, in the "retrospective" study; 3, in the "prospective" study. The upper limit of confidence interval at the 95% significance level for females is 50.5%. From this, it may be concluded that the majority of siding-type hiatal hernias occured in males.

Comparison with Prevalence, Other Investigators

Table 6 and 7 compare all types of hiatal hernia by age groups in the studies of Mobley and Christensen[40], of Nozaki[4], and in the present studies in individuals over 20 years of age. In Mobley and

Table 6. Numbers of hiatal hernias, all types, by age groups over 20 years age, comparison of ABCC studies and two other investigators

Age groups (Years)	Mobley and Christensen[40]	Nozaki[4]	ABCC*
20—29	1	4	—
30—39	9	3	2
40—49	31	2	3
50—59	42	3	9
60—69	50	6	15
70—79	16	1	8
80+	4	—	4
Total	153	19	41

* Retrospective and prospective studies combined.

Table 7. Hiatal hernia, sliding and paraesophageal type, by age groups and by sex; prospective study

Age	Male			Female		
	Number examined	Hiatal hernia	Percent	Number examined	Hiatal hernia	Percent
30—39	37	1	2.7	51	—	.....
40—49	37	—	.....	47	1	2.1
50—59	54	2	3.7	62	—	.....
60—69	59	2	3.4	56	3	5.4
70—79	13	1	7.7	15	1	6.6
80—89	2	—	.....	—	—	.....

Christensen's studies the prevalence rate was 5 per thousand, and the estimated incidence rate was 0.5—0.8 per thousand. The Nozaki series did not appear to show a definite relation with age, though most cases occurred between 60 and 69 years (Table 6). The present study showed an increasing prevalence of hiatal hernia with increasing age (Table 7).

Discussion

Hiatal hernia was studied "retrospectively" and "prospectively" in 2 separate series. Despite its smaller number of patients the "prospective" study again demonstrates that special efforts can detect more sliding-type hiatal hernias. Had intra-abdominal pressure been further increased by additional methods, the prevalence in the "prospective" study might have been higher. Hiatal hernia prevalence in this series was less than that reported outside Japan, but a prevalence approximating that of the Nozaki series was not demonstrated (Table 1b). However, comparison of these "retrospective" and "prospective" studies indicates that the true prevalence in Japan may be higher than generally reported[6,41].

Close association was found between hiatal herhia and age, the prevalence being higher in older age groups, as in other countries (Table 7). A correlation may exist between hiatal hernia and childbirth, particularly in the paraesophageal type as suggested in these studies.

Correlation of hiatal hernias with body height, weight and symptoms could not be established, nor was positive correlation with other diagnosed disease. However, the occurrence of duodenal diverticula in 2 cases of paraesophageal hernias was suggestive.

Summary

"Retrospective" and "prospective" studies consisting of review of roentgenological reports and roentgenograms of upper gastrointestinal examinations of cases with hiatal hernia were conducted. A prevalence of 0.6% was detected in the "retrospective" study; and 2.3% in the "prospective" study. This difference in prevalence is statistically significant and may be atrtibuted to differences in examination techniques. The only factor obviously correlated with hiatal hernia in this study was the age of the patient. Five cases of esophageal mucosal prolapse were detected in the "prospective" portion of this study.[37]

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