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Impact of gastric endoscopic submucosal dissection in elderly patients

The latest single center large cohort study with a review of the literature

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Abstract

With the increase in the elderly population, we are witnessing an increase in the rate of patients with underlying diseases and those under treatment with antithrombotic drugs.

In this study, we compared the treatment outcomes of endoscopic submucosal dissection (ESD) and other parameters in the following 3 groups: super-elderly, elderly, and nonelderly.

Compared with the other groups, the super-elderly group showed a significantly higher incidence of underlying diseases and the rate of antithrombotic treatment ($P < .05$). However, we observed no significant difference in the rate of curative resection or incidence of complications among the 3 groups. ESD is a relatively safe technique when performed on super-elderly patients. However, we have identified some cases in the super-elderly group, for which ESD was selected as a minimally invasive treatment for lesions that did not meet the inclusion criteria for open surgery as well as for which follow-up observations were selected rather than additional surgery for noncurative resections.

Further investigations concerning ESD are required, focusing on aspects such as indications, additional surgery, and informed consent of the patient or family, particularly when ESD is performed for super-elderly patients.

Abbreviations: ADL = activities of daily life, CT = computed tomography, ESD = endoscopic submucosal dissection, ly = lymph permeation, PS = performance statue, UL = ulcer, v = venous permeation.

Keywords: antithrombotic drug, early gastric cancer, elderly patient, endoscopic submucosal dissection

1. Introduction

According to the Japanese Ministry of Health, Labour and Welfare in 2015, the number of individuals aged over 65 years is expected to reach 36.57 million and reach a peak in 2042, at 38.78 million individuals. The proportion of elderly individuals aged over 75 years in the entire population is expected to exceed 25% by 2055.[1] Furthermore, the increased number of elderly in society has led to an increase in the occurrence of various underlying diseases as well as the rate of oral antithrombotic therapy.[2]

Nowadays, endoscopic submucosal dissection (ESD) has become a useful minimally invasive treatment for elderly patients with early-stage gastric cancer,[3–5] because it is less invasive than open surgical procedures and is highly advantageous in terms of organ preservation.[6,7] Recently, some patients in the expanded indications group, that is, very elderly patients (age over 80 years) who are taking anticoagulation drug, are treated by ESD. However, there are few discussions on this topic, such as the occurrence of procedure-related adverse events when performing ESD in elderly patients.[8–11]

In the present study, we retrospectively evaluated the therapeutic outcomes of ESD for elderly patients to clarify their benefit and harm.

2. Patients and methods

2.1. Patients

Among 501 lesions from 452 patients (mean age: 71.9 ± 9.5 years; male-to-female ratio: 328:124) who underwent ESD at our hospital between November 2012 and November 2016, those

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aged over 80 years constituted group A (107 lesions among 94 patients with a mean age of 83.9 ± 3.9 years and a male-to-female ratio of 65:29), those aged 65 to 79 years constituted group B (293 lesions among 266 patients with a mean age of 72.3 ± 4.2 years and a male-to-female ratio of 190:76), and those aged less than 65 years constituted group C (101 lesions among 92 patients with a mean age of 58.1 ± 6.2 years and a male-to-female ratio of 73:19).

2.2. ESD procedure

The GIF-Q260J (Olympus Medical Systems Corp, Tokyo, Japan) endoscope was primarily used. Devices used included the insulation-tipped diathermic knife (IT knife) 2 (Olympus Medical Systems Corp, Tokyo, Japan) and dual knife (Olympus Medical Systems Corp,). Totally, 20 mL of physiological saline with 0.8 mg of indigo carmine was used as the local injection solution.

The indications for endoscopic resection and postendoscopic resection evaluation were determined in accordance with the Japanese Classification of Gastric Carcinoma in 2016 (ver. 3).[12] Lesions that met absolute indications were defined as differentiated cancer diagnosed as macroscopic intramucosal carcinoma (cT1a) measuring less than 2 cm and lesions limited to UL (–), regardless of the macroscopic type. Lesions that met expanded indications were defined as

UL (–) cT1a differentiated carcinomas greater than 2 cm in diameter,

UL (+) cT1a differentiated carcinomas less than 3 cm in diameter, and

UL (–) cT1a undifferentiated carcinomas less than 2 cm in diameter.

Lesions exceeding the expanded indication were considered as the ones that did not meet the inclusion criteria for endoscopic treatment. Furthermore, curative resection was determined based on all the following criteria being met: the tumor is resected en bloc, is <2 cm in diameter, and is a differentiated type of cancer with a depth of pT1a, HM0, VM0, ly (–), and v (–). Curative resection for lesions that met the expanded indications is determined when the tumor is resected en bloc and the resected specimen is

(1) UL (–) pT1a differentiated carcinoma of ≥2 cm,
(2) UL (+) pT1a differentiated carcinoma of <3 cm,
(3) UL (–) pT1a undifferentiated carcinoma of <2 cm, or
(4) differentiated-type with pT1b (SM1) invasion (less than 500 μm from the muscularis mucosae) of <3 cm and HM0, VM0, ly (–), and v (–).

When one of the conditions in the absolute and expanded indications for curative resection is not met, it is defined as noncurative resection.

A proton pump inhibitor was administered to all patients on the day of ESD, and use was regularly continued for at least 56 days after ESD. Second-look endoscopy was not performed after ESD without post-ESD bleeding. Antithrombotic drug treatment was managed according to the JGES guidelines in 2014.[13]

2.3. Statistical analysis

The present study was performed with the approval of the Ethical Review Board of Tokyo Medical University Hospital (No. 2017-045). The 3 groups were compared in terms of the underlying disease, the presence or absence of oral antithrombotic therapy, therapeutic outcomes, the presence or absence of procedural accidents, and the treatment plan following noncurative resection. SPSS (version 22, Chicago, IL) was used for all statistical analyses. Analysis was performed using analysis of variance, and $P < .05$ was considered to indicate a significant difference.

3. Results

Upon comparing groups A, B, and C, the prevalence of underlying diseases, including heart disease, lung disease, kidney disease, and cerebrovascular disease, were 41.5% (39/94), 28.2% (39/94), and 9.8% (9/92), respectively, indicating a significantly higher prevalence in groups A and B than in group C. The rates of administering oral antithrombotic therapy were 33.0% (31/94), 22.2% (59/266), and 6.5% (6/92) in groups A, B, and C, respectively, and this rate was found to significantly increase with age (Table 1).

3.1. ESD treatment outcomes

There were 73, 236, and 83 lesions corresponding to the indications in the guidelines; 27, 51, and 14 lesions that met the expanded indications, and 7, 6, and 4 lesions in groups A, B, and C, respectively that did not meet the inclusion criteria for ESD. On comparing the pathological diagnosis of the resected specimens in each of the 3 groups in terms of differentiation, depth, presence or absence of ulceration, lymphatic invasion, and vascular invasion, no significant difference was observed (Table 2) (Fig. 1).

On comparing groups A, B, and C, there was no significant difference observed in the en bloc resection rate (96.3%

Table 1

Patient's characteristics.

	>80 yr old Group A	65–79 yr old Group B	<65 yr old Group C	*P*-value
N (patients)	94	266	92	
Age	83.9 ± 3.9 (80–98)	72.3 ± 4.2 (65–79)	58.1 ± 6.2 (36–64)	
Male/female	65/29	190/76	73/19	
Prevalence of comorbidity	41.5% (39/94)	28.2% (75/266)	9.8% (9/92)	$P < .001$ (AvsBvsC)
Cardiovascular disease	24.5% (23/94)	18.8% (50/266)	5.4% (5/92)	
Respiratory disease	2.1% (2/94)	7.1% (19/266)	0.0% (0/92)	
Cerebral vessel disease	14.9% (14/94)	7.1% (19/266)	1.1% (1/92)	
Renal failure	5.3% (5/94)	2.6% (7/266)	2.2% (2/92)	
Use rate of the antithrombotic drugs	33.0% (31/94)	22.2% (59/266)	6.5% (6/92)	$P < .001$ (AvsC,BvsC)

Group A: super elderly patients (>80 yr old), Group B: elderly patients (65–79 yr old), Group C: nonelderly patients 65 years.

Table 2

Categories of lesion.

	>80 yr old	65–79 yr old	<65 yr old	*P*-value
	Group A	Group B	Group C	
N (lesions)	107	293	101	
Location, U/M/L	22/24/61	52/82/159	15/27/59	
Tumor size, mm	17.5±14.2	15.6±9.6	13.1±8.2	
Absolute indication lesion	68.2% (73/107)	80.5% (236/293)	82.2% (83/101)	
Expanded indication lesion	25.2% (27/107)	17.4% (51/293)	13.9% (14/101)	
Contraindication lesion	6.5% (7/107)	2.0% (6/293)	4.0% (4/101)	
Histological type				*P*=.925
Predominantly differentiated	95.3% (102/107)	95.9% (281/293)	95.0% (96/101)	
Predominantly undifferentiated	4.7% (5/107)	4.1%(12/293)	5.0% (5/101)	
Depth of invasion				*p*=.223
M	89.7% (96/107)	86.3% (253/293)	92.0% (93/101)	
SM1	5.6% (6/107)	6.8% (20/293)	5.0% (5/101)	
SM2	4.7% (5/107)	6.8% (20/293)	3.0% (3/101)	
Ulcer	11.2% (12/107)	9.9% (29/293)	5.0% (5/101)	*P*=.132
Lymphatic invasion positive	8.4% (9/107)	6.5% (19/293)	2.0% (2/101)	*P*=.128
Vascular invasion positive	5.6% (6/107)	4.1% (12/293)	1.0% (1/101)	*P*=.201

Group A: super elderly patients (>80 yr old), Group B: elderly patients (65–79 yr old),
Group C: nonelderly patients 65 years.
Location: L, lower stomach; M, middle stomach; U, upper stomach.
Depth of invasion: M, mucosal cancer; SM1, tumor infiltration into the submucosal layer <500 μm from the muscularis mucosae; SM2, tumor infiltration into the submucosal layer >500 μm from the muscularis mucosae.

[103/107], 98.0% [287/293], and 94.1% [95/101]), complete en bloc resection rate (91.6% [98/107], 93.5% [274/293], and 94.1% [95/101]), and curative resection rate (82.2% [88/107], 84.3% [246/293], and 89.1% [90/101]), respectively. On comparing the duration of endoscopic treatment between the 3 groups, there was no significant difference found. Furthermore, the incidence of procedural accidents of bleeding, perforation, and aspiration pneumonitis between groups A, B, and C was 9.6% (9/94), 7.5% (20/266), and 4.3% (4/92), respectively, with no significant difference observed. On the other hand, the rate of additional surgery performed for noncurative lesions was 15.8% (3/19), 58.7% (27/46), and 63.6% (7/11) in groups A, B, and C, respectively, indicating a significantly lower rate in group A than in groups B and C. Moreover, the length of the hospital stay was significantly shorter in group C than in groups A and B (Table 3).

3.2. Correlation with antithrombotic drugs

Oral antithrombotic therapy was used in 96 of the 452 patients, accounting for 21.2% overall (mean age: 76.5±7.3, male-to-female ratio of 73:23, and oral antithrombotic therapy with a single agent-to-multiple agents ratio of 73/23 patients). Compared to the group that did not receive oral antithrombotic therapy, the rate of after-bleeding was significantly higher (group with oral antithrombotic therapy vs the group without oral antithrombotic therapy: 10.4% >4.8%, $P=.038$).

The rate of after-bleeding in patients receiving oral antithrombotic therapy reached 10.4% (11/96) and was significantly higher for patients receiving multiple agent oral therapies ($P=.042$) and patients with heparinization ($P=.036$). Compared to patients without heparinization, those with heparinization had significantly longer hospital stays (16.3±4.0 vs 8.1±2.0 days; $P<.001$) than those who accumulated significantly higher medical care fee points during hospitalization (62905±12348 points vs 48653±18136 points ($P=.003$). There were no cases of thrombotic procedural accidents in the group with heparinization or the group without (Tables 4 and 5).

3.3. Noncurative cases

Among the patients in group A, the 19 cases with noncurative resections are presented in Table 6. Of these 19 patients, 3 patients underwent an additional surgical resection, 2 patients underwent additional endoscopic treatment by ESD or argon plasma coagulation, and 15 patients underwent follow-up observation. Follow-up observation at our hospital for noncurative resection cases involves examination for localized recurrence by endoscopy or CT at 6 months to 1 year following ESD. Five patients passed away while undergoing follow-up, including 3 patients who died from other causes after ESD; 1 patient who had multiple metastasis following ESD, and 1 patient who died due to poor nutritional status after additional surgery.

4. Discussion

Endoscopic mucosal resection was developed in the 1980s and led to the widespread popularity of endoscopic treatment for early-stage gastric cancer.[14] Subsequently, in the 1990s, the development of the IT knife and the advent of various devices led to the rapid popularization of ESD in Japan.[15,16] Advantages of ESD include that it enables en bloc resection even of extensive lesions and accurate pathological evaluation.[17–22] Furthermore, the aging of the population is associated with an increased number of cases in which the selection of minimally invasive surgery is recommended for elderly patients from various perspectives, including postoperative quality of life (QOL) and procedural accidents.[23–25] Compared to open surgical procedures, ESD is minimally invasive, and has thus been established at various institutions as a highly effective endoscopic treatment for elderly patients. Reports of ESD in elderly patients are associated with various controversies, and many points remain unclear regarding safety, postoperative ADL (activities of daily life), and the approach for lesions that do not meet the inclusion criteria. In the present study, we analyzed the characteristics of the

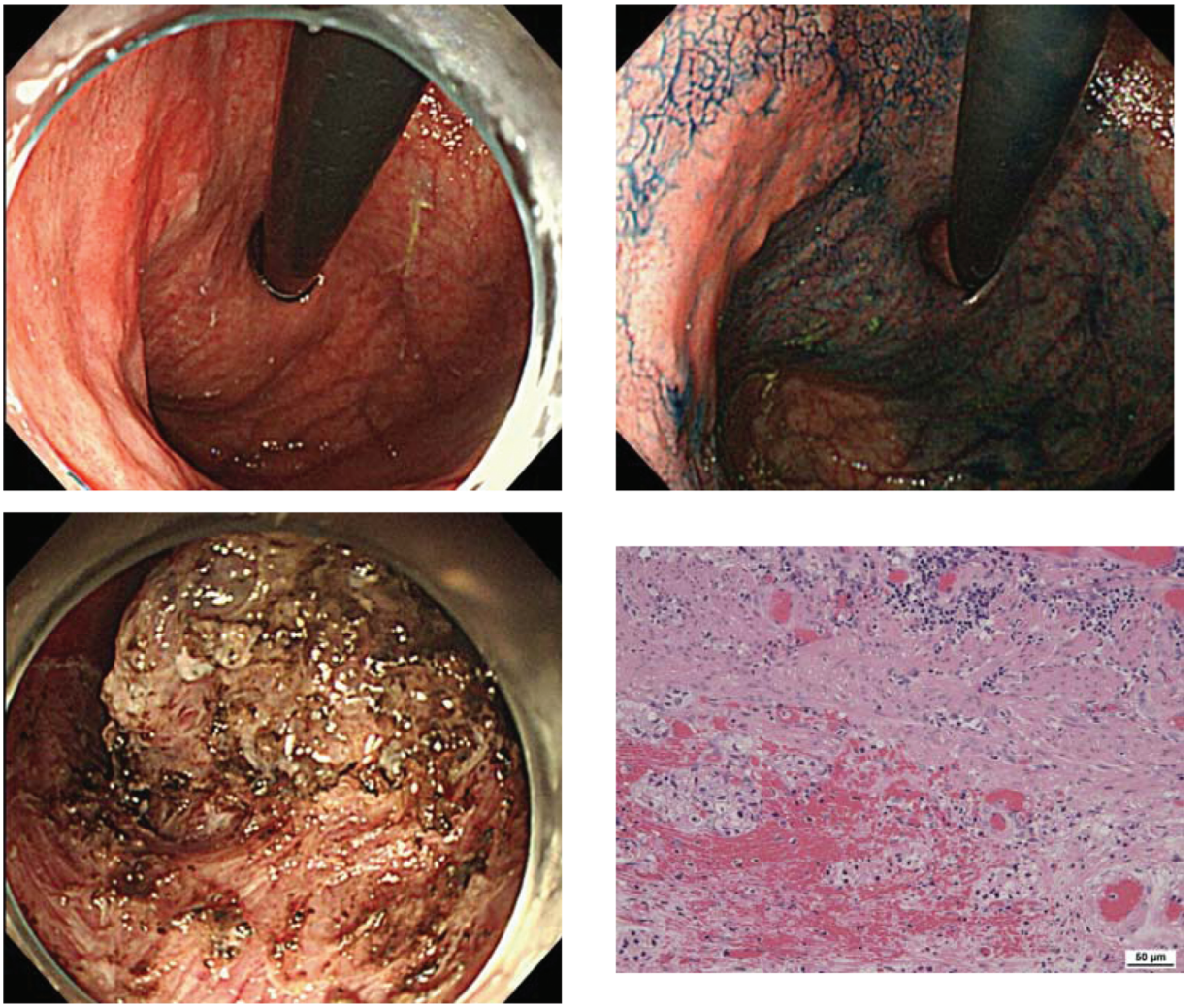

Figure 1. A 91-year-old man presenting a 0-IIa lesion measuring 25 mm in the posterior wall of the upper gastric body, with por2 > sig (preoperative biopsy). Although the lesion did not meet the inclusion criteria, en bloc resection was performed by ESD as per the wishes of the patient's family. Pathological findings included por2 > sig, 0-IIa, 18 × 18 mm, pT1b2 (SM2 ≧800 μm), UL (−), ly (+), v (+), HM0, and VM1. The procedure was deemed a noncurative resection. Upon performing additional surgery, the subject developed postgastrectomy syndrome 1 month after surgery, which led to the gradual deterioration of his nutritional status due to impaired food intake. Seven months after surgery, the subject went into septic shock caused by a urinary tract infection and passed away. ESD = endoscopic submucosal dissection.

Table 3

Treatment outcomes.

	>80 yr old	65–79 yr old	<65 yr old	*P*-value
	Group A	Group B	Group C	
N (patients/lesions)	94/107	266/293	92/101	
Complete en bloc resection rate	91.6% (98/107)	93.5% (274/293)	94.1% (95/101)	*P* = .741
Curative resection for absolute indication	58.9% (63/107)	57.7% (169/293)	73.3% (74/101)	
Curative resection for expanded indication	23.4% (25/107)	26.6% (78/293)	15.8% (16/101)	
Noncurative resection	17.8% (19/107)	15.7% (47/293)	11.0% (11/101)	
Curative resection for absolute and expanded indication	82.2% (88/107)	84.3% (246/293)	89.1% (90/101)	*P* = .286
Rate of additional operation for the noncurative resection	15.8% (3/19)	58.7% (27/46)	63.6% (7/11)	*P* < .001 (AvsB, AvsC)
Rate of complications	9.6% (9/94)	7.5% (20/266)	4.3% (4/92)	*P* = .314
Delayed bleeding	6.4% (6/94)	6.4% (17/266)	4.3% (4/92)	*P* = .717
Perforation	3.2% (3/94)	0.8% (2/266)	0.0% (0/92)	*P* = .079
Aspiration pneumonitis	0.0% (0/94)	0.4% (1/266)	0.0% (0/92)	*P* = .706
Operation time	117.6 ± 92.5	103.8 ± 71.4	109.6 ± 63.7	*P* = .346
Days of hospitalization	9.4 ± 5.3	8.0 ± 2.9	7.2 ± 1.6	*P* < .001 (AvsC, BvsC)

Group A: super elderly patients (>80 yr old), Group B: elderly patients (65–79 yr old),
Group C: nonelderly patients 65 years.

Table 4

Characteristics of 96 patients receiving antithrombotic therapy.

N	96	
Age	76.5 ± 7.3	
Male/female	73/23	
Comorbidity		
Cerebral infraction	30	31.3%
Ischemic heart disease	43	44.8%
Atrial fibrillation	18	18.8%
Internal carotid artery constriction	6	6.3%
Deep-vein thrombosis	3	3.1%
Arteriosclerosis obliterans	2	2.1%
Antithrombotic agents		
Aspirin	50	52.1%
Thienopyridine	24	25.0%
Cilostazol	13	13.5%
Other antiplatelet drugs	13	13.5%
Warfarin	11	11.5%
Novel oral anticoagulants (NOACs)	9	9.4%

therapeutic outcomes of ESD in elderly patients and examined the indications of ESD for elderly patients.

The prevalence of underlying disease, and the rate of oral antithrombotic therapy were both significantly higher in elderly patients; however, there was no significant difference between the 3 groups in terms of the curative resection rate, treatment duration, and the incidence of procedural accidents. Thus, ESD was considered to be performed relatively safer for elderly patients. The reason that the hospital stay was significantly longer in groups A and B is thought to be attributed to the fact that careful follow-up observation was required following the endoscopic treatment for elderly patients with procedural accidents, and with low PS. Furthermore, in patients aged younger than 65 years, the rate of oral antithrombotic therapy was low, and there were few patients with heparinization, which was thought to have resulted in shorter hospital stays.

Patients receiving oral antithrombotic therapy are considered to be at high risk of developing thrombosis upon drug cessation; thus, heparinization was administered in accordance with the guidelines.[26] However, in recent years, the risk of hemorrhage in heparinization has gradually become clear.[27,28] Furthermore, disadvantages arise in routine clinical practice (eg, complications at hospital admission, and longer hospital stays). With the increased incidence of underlying diseases, there are many elderly patients who undergo oral antithrombotic therapy for the prevention of cerebrovascular and cardiovascular disease. In addition to the increased risk of late bleeding, since there is a negative medical economic effect (eg, the length of the hospital stay and cost of medical care), we believe that the continuation of antithrombotic therapy and the need for heparinization should be examined from various perspectives.

Group A included some patients for whom ESD was selected as minimally invasive treatment rather than open surgery for lesions that do not meet the inclusion criteria, as well as some patients who underwent follow-up observation without additional surgery for noncurative resection. In the present study, while the safety of ESD was suggested, a few procedural events occurred, including bleeding and perforation.

Until January 2018, the ESD study that compared with an elderly person and the nonelderly person was 11 cases in total (Table 7).[23,29–38] Those studies reported the en bloc resection rates and complication. Most of these studies describe that there is not significant difference in en bloc resection rate and complication between the 2 groups similar to the present study.

Among limitations, in elderly patients, some procedures become fatal because the patients have considerably reduced residual function of various organs. Thus, more careful consideration for the treatment and management of the patient's general condition is required. It has been reported that additional surgery for noncurative resection can help to improve the survival rate.[38,39]However, as seen in the case presented above, there are some patients who undergo an additional resection for non-curative lesions by ESD, which consequently leads to the deterioration of their nutritional status due to impaired food intake caused by postgastrectomy syndrome; therefore, in cases of elderly patients, judgment can be difficult. While ESD is advantageous since it enables the removal of cancer, the burden of minimally invasive surgery cannot be ignored, and follow-up observation can also be considered an option. Additional surgery for elderly patients remains controversial and while there are no established clear determination criteria. Therefore, in addition to age, some experts consider that ADL, PS (performance statue), and the prognostic nutritional index (Onodera's PNI) could serve as factors to determine the treatment plan.[40–41,5] Elderly patients are at high risk of dying from other diseases, and the treatment should be carefully determined, taking ADL and nutritional status into consideration. In the present study, on comparing the pathological diagnosis in terms of differentiation, depth, presence or absence of ulceration, lymphatic invasion, and vascular invasion, no significant difference was observed. On the other hand, there are reports that pathological risk factors are

Table 5

Treatment outcome of 96 patients receiving antithrombotic therapy.

	Delayed bleeding	***P*_value**
Single antithrombotic	5/73 (6.8%)	$P = .042$
versus	versus	
Multiple antithrombotics	5/23 (21.7%)	
No heparin bridging	6/80 (7.5%)	$P = .036$
versus	versus	
Heparin bridging	4/16 (25.0%)	

	Heparin bridging	**No heparin bridging**	***P*-value**
N	16/96 (16.7%)	80/96 (83.3%)	
Delayed bleeding	4/16 (25.0%)	6/80 (7.5%)	$P = .036$
Days of hospitalization	16.3 ± 4.0	8.1 ± 2.0	$P < .001$
Hospitalization request score	62905 ± 12348	48653 ± 18136	$P = .003$

Table 6

Noncurative resection in over 80 yr patients.

Case	Gender	Preoperated diagnosis	Location	Histological type	Size	Invasion	Age	ly	v	ul	Margin	resection	Additional treatment	Vital status	Cause of death in fatal cases	Follow up period
1	Male	Expanded indication lesion	L	por1>tub2>tub1 >pap>sig=por2	42	M	80	+	–	–	Negative	En bloc resection	Follow up	Alive		54 mo
2	Male	Contraindication lesion	U	tub2>tub1>por2	27	SM2	90	–	+	-	Unclear	En bloc resection	Follow up	Alive		50 mo
3	Male	Absolute indication lesion	L	unlear	10	unclear	80	–	–	–	Unclear	Piecemeal resection	ESD	Alive		45 mo
4	Male	Expanded indication lesion	M	tub2>por	15	SM1	91	+	–	–	Negative	En bloc resection	Follow up	Dead	Cerebral infarction	13 mo
5	Male	Expanded indication lesion	U	tub2>por2>tub1	45	SM1	86	–	–	+	Negative	En bloc resection	Follow up	Dead	Pneumonia	19 mo
6	Male	Contraindication lesion	M	por1+sig>tub2	15	SM2	86	+	+	–	Negative	En bloc resection	follow up	Dead	Untraceable	12 mo
7	Female	Expanded indication lesion	L	pap>tub1>tub2	58	SM1	81	+	–	–	Negative	En bloc resection	Surgery	Alive		31 mo
8	Female	Absolute indication lesion	U	tub1>tub2>pap	14	M	83	–	–	–	Positive	En bloc resection	Follow up	Alive		25 mo
9	Male	Contraindication lesion	U	sig>por2>tub2	25	M	80	–	–	+	Positive	En bloc resection	Follow up	Alive		24 mo
10	Male	Contraindication lesion	U	por2>sig	18	SM2	91	+	+	–	Positive	En bloc resection	Surgery	Dead	Postoperative nutritional disorder	10 mo
11	Male	Contraindication lesion	U	tub1>pap	65	M	82	–	–	+	Unclear	En bloc resection	Follow up	Alive		21 mo
12	Male	Expanded indication lesion	U	tub1	34	M	89	–	–	+	Negative	En bloc resection	Follow up	Alive		21 mo
13	Male	Expanded indication lesion	M	tub2>tub1	20	SM1	85	–	–	–	Positive	En bloc resection	Follow up	Dead	Lumbar pressure fracture	7 mo
14	Male	Expanded indication lesion	U	tub2>tub1>por2	26	SM2	80	+	+	+	Positive	En bloc resection	Follow up	Alive		16 mo
15	Female	Absolute indication lesion	L	por2>tub2	40	SM2	91	+	+	–	pPM pDM	No resection*	Surgery	Dead	Metastasis (liver and lung)	12 mo
16	Male	Absolute indication lesion	M	unclear	10	unclear	83					No resection*	APC	Alive		14 mo
17	Male	Expanded indication lesion	L	tub1>tub2 tub1>pap	54	SM1	84	+	–	+	Negative	En bloc resection	Follow up	Alive		7 mo
18	Male	Contraindication lesion	L	tub1>tub2	11	SM2	86	+	+	–	Negative	En bloc resection	Follow up	Alive		7 mo
19	Male	Absolute indication lesion	L	tub1	8	M	87	–	–	–	Unclear	Piecemeal resection	Follow up	Alive		

ly = lymph permeation, ul = ulcer, v = venous permeation.
* A case was difficult and was finished on the way

Table 7

Characteristics of study for elderly patient's ESD.

Study	First author	Year	Study period	Elderly Gorup Age	N	M/F	Comorbidity	Use of antithrombotic agents	Location (U/M/L)	Depth (M/SM)	Tumor size	En bloc resection rate	Perforation	Delayed bleeding	Pneumonia
1	Kato	2016	2006–2013	≧75	E = 345 NE = 547	E = 238/107 NE = 441/106	$P<.05$	$P<.05$	E = 77/210/134 NE = 102/332/207	E = 386/35 NE = 572/69	E = 17.5 NE = 16.6	n.s.	n.s.	ns.	$P<.05$
2	Komori	2016	2002–2012	≧80	E = 22 NE = 67	E = 14/8 NE = 54/13	$P<.05$	$P<.05$	E = 4/8/12 NE = 15/35/30	ND	E = 15.2 NE = 14.4	n.s.	n.s.	n.s.	ns.
3	Yang	2015	2005–2014	≧75	E = 44 NE = 42	E = 36/8 NE = 29/13	$P<.05$	n.s.	E = 0/28/16 NE =1/18/23	E = 33/11 NE = 37/4	E = 22.0 NE = 19.5	n.s.	n.s.	n.s.	ns.
4	Chinda	2015	2004–2009	≧75	E = 102 NE = 205	E = 65/37 NE = 157/48	$P<.05$	$P<.05$	ND	ND	E = 23.5 NE = 20.1	n.s.	n.s.	n.s.	n.s.
5	Zhang	2014	2010–2013	≧75	E = 46 NE = 125	E = 33/13 NE = 79/46	$P<.05$	ND	E = 9/17/24 NE = 9/44/83	E = 40/11 NE = 129/7	E = 19.0 NE = 20.0	n.s.	n.s.	n.s.	ns.
6	Murata	2014	2009–2011	≧80	E = 5525 NE = 21,860	E = 3619/1906 NE = 16,657/5203	$P<.05$	$P<.05$	E = 1880/12001/7979 NE = 9/17/24	ND	ND	ND	n.s.	n.s.	ns.
7	Tokioka	2012	2002–2010	≧65	E = 372 NE = 143	E = 260/112 NE = 118/25	$P<.05$	$P<.05$	E = 25/109/229 NE = 23/45/74	E = 367/5 NE = 138/5	E = 15.1 NE = 14.5	n.s.	n.s.	n.s.	ns.
8	Toyokawa	2011	2003–2009	≧75	E = 200 NE = 314	E = 128/72 NE = 237/77	$P<.05$	$P<.05$	E = 54/76/98 NE = 93/141/122	E = 201/28 NE = 316/41	E = 19.0 NE = 18.0	n.s.	n.s.	$P<.05$	ns.
9	Isomoto	2010	2001–2007	≧75	E = 279 NE = 434	E = 173/106 NE = 343/91	ND	ND	E = 44/129/105 NE = 73/209/149	E = 222/57 NE = 369/65	E = 20.0 NE = 19.0	$P<.05$	n.s.	n.s.	$P<.05$
10	Kakushima	2007	2000–2004	≧75	E = 49 NE = 135	ND	ND	ND	E = 9/13/27 NE = ND	E = 41/8 NE = ND	E = 22.7 NE = ND	n.s.	n.s.	n.s.	ND
11	Hirasaki	2005	2000–2004	≧75	E = 53 NE = 91	E = 34/19 NE = 74/17	$P<.05$	$P<.05$	ND	E = 47/6 NE = 83/8	E = 12.2 NE = 13.0	n.s.	n.s.	n.s.	ND

E = elderly patients, NE = nonelderly patients.

M: male, F: female. Location: U, upper stomach; M, middle stomach; L, lower stomach.

Depth of invasion: M, mucosal cancer; SM, tumor infiltration into the submucosal layer, n.s.: elderly patients were not significantly different from those of nonelderly patients. ND: not described.

very important. By early stomach cancer treatment study group, they have established a risk-scoring system, termed the "eCura system," for the risk stratification of lymph node metastasis in patients who have received noncurative ESD for early gastric cancer.[42] The eCura system seems to be useful for selection of a treatment policy after ESD for elderly people.

In our hospital, treatment decisions for elderly patients are made with regard to ADL, PS, age, and comorbidities. We believe that prior to surgery, the patient concerned and his or her family members should be fully informed of the significance of treatment, as well as possible procedural accidents. Furthermore, informed consent should be obtained.

There are several limitations for this study. First, it was a retrospective study and performed at a single center, which may introduce bias into the results of the study. Second, the number of patients in the super-elderly patients is small. Third, technical problems by ESD operators may have a considerable impact on complications. Fourth, we did not compare survival rates in super-elderly patients between those who underwent ESD and those who did not. However, even considering these limitations, the results of this study are clinically meaningful.

In conclusion, ESD appears to be safely performed, even in elderly patients. In contrast, when performing ESD although further examination is needed with regards to the indications, criteria for determining whether or not to perform additional surgery in the future.

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