Intraoperative Optical Imaging for Intraoperative Diagnosis of Tumor Invasiveness in Gallbladder Carcinoma – Narrow Band Imaging and Infrared Fluorescence Imaging with Indocyanine Green

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【Introduction】

Determining tumor invasiveness before operation is one of the most important unsolved issues in the management of gallbladder cancer. We hypothesized that the assessment of irregular vessels on the gallbladder wall may be useful for detecting subserosal infiltration. We showed an initial report on the clinical usefulness of laparoscopic narrow band imaging (NBI) for the intraoperative diagnosis of tumor invasiveness in gallbladder carcinoma. Now, we report additional effects of intraoperative optical imaging not only NBI but also infrared (IR) fluorescence imaging with indocyanine green (ICG).

Diagnostic accuracies of depth of invasion
EUS: 55.5%
MD-CT: 44.4%
High resolution US: 62.9%
(Jang JY et al. Ann Surg 2009)

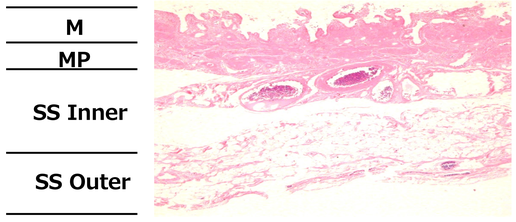


Fig.1 Anatomical structure of gallbladder wall

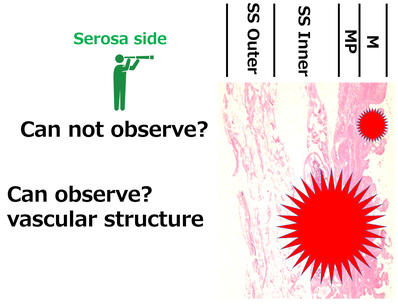
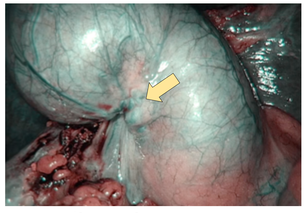


Fig.2 Relationship between NBI findings and GB cancer

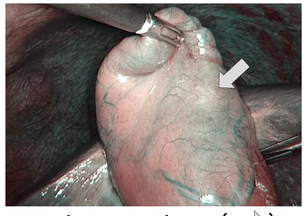
【Patients and methods】

- Patients with GB diseases (Oita University2014.7～)
- GB were observed using NBI and microvasculature was evaluated. Additionally, we observed surface on GB with IR fluorescence imaging with ICG. (Approved No.1085)
- Patients with
  - ・Benign diseases
  - ・GB cancer

  (Patients with tumors located in the liver bed were excluded.)
- **27 patients with NBI** & **3 patients with ICG** were included



- dilatation
- tortuousness (⇨)



- interruption (⇨)
- heterogeneity

Fig.3 Intraoperative NBI positive findings

【Results (NBI)】

NBI positive					NBI negative			
Age/Sex	Preop. EUS	NBI findings	depth	vessel invasion	Age/Sex	Preop. EUS	depth	vessel invasion
71/F	NA	Int・He	ss	v0, ly1	46/F	type B	mp	v0, ly0
81/M	type C	Int・He	ss	v1, ly1	73/M	type C	ss	v0, ly0
79/M	NA	Int・He	ss	v1, ly2	56/F	type C	ss	v0, ly0
66/M	type C	He	ss	v1, ly1	68/F	type B	mp	v0, ly0
84/F	NA	He	ss	v0, ly3	74/F	type B	adenoma	
81/F	type B	He	ss	v0, ly2	75/M	type B	ss	v0, ly0
84/M	NA	Di・Tor	ss	v0, ly2	60/F	type B	polyp	
84/F	type B	He	ss	v0, ly2	80/F	NA	ss	v2, ly2
78/F	type C	He	ss	v0, ly1	59/M	type B	polyp	
85/M	NA	He	ss	v1, ly1	43/F	NA	ADM	
76/M	type D	Di・He	hep	v1, ly1	45/F	type B	Chronic cholecystitis	
					78/M	type B	polyp	
					68/F	NA	ADM	
					79/M	NA	mp	v0, ly0
					81/M	type B	adenoma	
					70/M	type C	m	v0, ly0
					80/M	type B	Chronic cholecystitis	
					80/M	type B	mp	v0, ly0
					69/M	NA	Chronic cholecystitis	
					72/M	typeB	ss	v0, ly0

Int, interruption; He, heterogeneity
Di, dilatation; Tor, tortuousness
11 cases are positive in NBI.
20 cases are negative in NBI.

Sensitivity: 91.7%, Specificity: 100%
Accuracy: 96.9%

【Summery】

- ●The serosal surface of the tumor site and its microvasculature were successfully observed in all 31 patients.
- ●Laparoscopic NBI detected at least one abnormal finding in eleven patients, and postoperative pathology showed subserosal infiltration accompanied by vessel invasion.
- ●On the contrary, twenty patients with no positive NBI findings showed mild or no subserosal infiltration and no vessel invasion.
- ●ICG imaging detected obvious fluorescence augmentation in the NBI positive patients.

【Conclusion】

Our study indicated that laparoscopic NBI may be useful for diagnosing subserosal infiltration accompanied by vessel invasion. IR imaging with ICG has possibility to more accurately diagnose than NBI findings.

【Results (NBI and ICG imaging)】

Case :74-year-old male
Preoperative diagnosis is GB Cancer.
cT3a(hep)N0M0 Stage IIIa

Fig.4 Wall thickening and liver invasion

tortuousness (⇨) interruption (⇨)

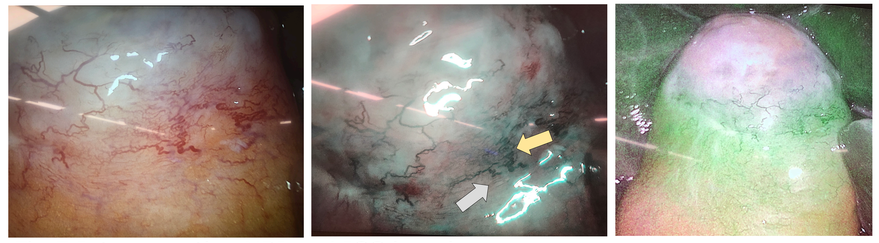
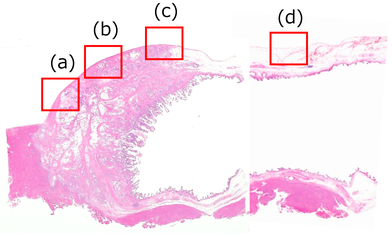
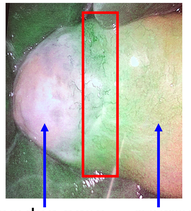


Fig.5 Intraoperative NBI and ICG imaging

Staging laparoscopy
Extended cholecystectomy

Pathological Diagnosis
Gf, circ, 20×20mm, nodular-infiltrating type, tub2>muc>pap, pT3a(HEP), int, INFb, ly1, v1, ne1, pN0(0/9), pStage ⅢA, pCM0, pEM0.





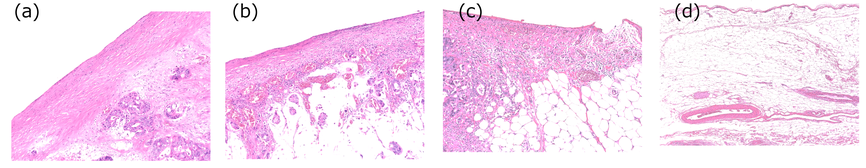


Fig.6 Angiogenesis in subserosal layer by tumor invasion