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## No incidence of port-site recurrence after endosurgical procedure for pediatric malignancies

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**Abstract** Port-site recurrence (PSR) following laparoscopic procedures has been an unpredictable complication in adult cancer patients; however, no data exist about this phenomenon in the pediatric field. The aim of this study was to determine whether PSR, following endosurgical procedure for malignancies, is a typical complication or a rare event in the pediatric population. Eighty-one questionnaires were mailed to members of The Japanese Society of Pediatric Endosurgeons. They were asked to provide a list of their institutions that had experience with PSR after endosurgical procedures for pediatric malignancies. Among 29 institutions, a total of 129 endosurgical procedures for pediatric malignancies were reported; these included 85 laparoscopic and 44 thoracoscopic procedures, performed on 104 neuroblastomas, 8 hepatoblastomas, 7 nephroblastomas, and 10 other tumors. Of the 104 neuroblastomas, 83 were found by mass screening using high levels of urinary vanillylmandelic acid and homovanillic acid. Sixty-five of the 83 patients had their tumor excised, and 18 had their tumor biopsied by endosurgical procedures. Additionally, 47 of these patients did not require any postoperative chemotherapy. No incidence of PSR was reported in any of the patients that underwent endosurgical procedures. The PSR following endosurgical procedure is a rare phenomenon in the pediatric population. Both, laparoscopic and thoracoscopic procedures, are safe and

recommended for treating pediatric malignancies, especially mass-screened neuroblastomas.

**Keywords** Endosurgery · Port-site recurrence · Malignancy · Neuroblastoma · Children

### Introduction

In recent years the use of minimally invasive surgery has become commonplace for the treatment of some adult cancers, such as colon cancer, ovarian cancer, gallbladder cancer, and gastric cancer [14]. Port-site recurrence (PSR) after laparoscopic surgery is a serious complication and has been reported in operations for various kinds of abdominal cancer. The incidence of PSR after laparoscopic colectomy and cholecystectomy is reported to be 3.9% (16 of 412) and 17.1% (70 of 409), respectively [8]; however, the etiology and mechanism of PSR remains unclear [6, 11].

There has been an explosion in the number of minimally invasive surgeries being performed for pediatric malignancies [1, 2, 3, 7, 9, 12], but only one case of PSR following thoracoscopic surgery for osteogenic sarcoma has been reported [10]. Using a murine model, researchers have shown that PSR following endosurgical procedures can be prevented by postoperative high-dose chemotherapy [4]. Nevertheless, there are no data on the incidence of PSR and the efficacy of postoperative chemotherapy in the pediatric field. The aim of this study is to determine whether PSR, following endosurgical procedure for malignancies, is a typical complication or a rare event in the pediatric population.

### Materials and methods

In September of 2001 we mailed 81 questionnaires to member institutions of The Japanese Society of Pediatric Endosurgeons. The questionnaire explained the purpose of the study and asked for

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a list of endosurgical procedures performed at their institution for pediatric malignancies. A second, more detailed questionnaire was designed to focus on tumor location, tumor stage, tumor pathology, endosurgical procedure, pre- and post-operative chemotherapy, and incidence of PSR. The third and final questionnaire inquired about the incidence of PSR, as seen on long-term follow-up, and was mailed only to those institutions that had performed endosurgical procedures for pediatric malignancies in February 2002.

## Results

Sixty-one of 81 institutions returned the first questionnaire (75.3%), of which 32 institutions had no experience with endosurgical procedures for pediatric malignancies. A total of 129 endosurgical procedures for pediatric malignancies were performed among the remaining 29 institutions between 1994 and 2001, and follow-up period of these cases was from 5 months to 8 years. The most common malignancy was neuroblastoma, with liver tumor being a distant second (Table 1). The most common procedure was laparoscopic excision of tumor followed by thoracoscopic excision of tumor (Table 2). Of the 104 neuroblastomas, 80 patients had their tumor excised by endosurgical procedures, and 51 of 80 patients (63.8%) did not undergo postoperative chemotherapy (Table 3). Eighty-three patients were found by mass-screening using high levels of urinary vanillylmandelic acid and homovanillic acid. Of the 83 patients, 65 had their tumor excised, and 18 had their tumor biopsied. Forty-four of these 65 patients (67.7%) did not receive any postoperative chemotherapy. In 25 other tumors, 13 thoracoscopic excision, 5 thoracoscopic biopsy, 5 laparoscopic excision, and 2 laparoscopic biopsy were performed. Twelve of 13 thoracoscopic excision were done for pulmonary metastases of hepatoblastoma, nephroblastoma, etc.

Local recurrence was found in 7 patients (Table 4). The recurrence of the lung after thoracoscopic excision was common in hepatoblastoma, osteosarcoma, and nephroblastoma. In patients with neuroblastoma, only one case of excised stage-IV adrenal neuroblastoma with

**Table 1** Endosurgical procedures performed by primary disease

Primary disease	No. of cases
Neuroblastoma	104
Liver tumor	8
Nephroblastoma	7
Lymphoma	3
Pancreatic tumor	3
Teratoma	2
Osteogenic sarcoma	1
Round cell tumor	1

**Table 2** Endosurgical procedure performed for pediatric malignancies

Endosurgical procedure	No. of cases
Laparosco picexcision	61
Laparosco picbiopsy	21
Thorosco picexcision	38
Thorosco picbiopsy	11

Two cases underwent both laparoscopic surgery and thoracoscopic surgery

lymphadenectomy had local lymph node recurrence. No PSR was detected in any patient after endosurgical procedures.

## Discussion

Endosurgical procedure for pediatric malignancies supposedly results in an earlier return of bowel function, earlier start of postoperative chemotherapy, and earlier discharge of the patient from the hospital [3]; however, there are no data on PSR in the pediatric field. In this study we sought to evaluate (a) whether PSR is a typical complication or a rare event in the pediatric population, and (b) the efficacy of chemotherapy following endosurgical procedure for pediatric malignancies, in the prevention of PSR.

**Table 3** Endosurgical procedure performed for neuroblastoma. Postop CTx postoperative chemotherapy

	Neuroblastoma (total) <i>n</i> = 104	Postop CTx <i>n</i> = 49	Neuroblastoma (mass-screened) <i>n</i> = 83	Postop CTx <i>n</i> = 36
Stage I	66	21	58	19
Biopsy	3	1	3	1
Excision	63	20	55	18
Stage II	9	3	9	3
Biopsy	4	3	4	3
Excision	5	0	5	0
Stage III	16	16	11	11
Biopsy	12	12	9	9
Excision	4	4	2	2
Stage IV	10	8	2	2
Biopsy	5	4	2	2
Excision	5	4	0	0
Stage IVS	3	1	3	1
Excision	3	1	3	1

**Table 4** Local recurrence after endosurgical procedure. *TE* thoracoscopic excision, *TB* thoracoscopic biopsy, *LE* Laparoscopic excision

Case no.	Age (years)	Primary disease	Stage	Location of tumor	Endosurgical procedure	Location of recurrence
1	1.4	Hepatoblastoma	4	Lung metastasis	TE	lung
2	1.9	Hepatoblastoma	4	Lung metastasis	TE	lung
3	10	Hepatoblastoma	4	Lung metastasis	TE	lung
4	12	Osteosarcoma	4	Lung metastasis	TE	lung
5	1.1	Nephroblastoma	4	Lung metastasis	TB	lung
6	3	Nephroblastoma	2	Kidney	LE	diaphragma
7	5.5	Neuroblastoma	4	Adrenal gland	LE	lymph nodes

Questionnaires were mailed to 81 member institutions of The Japanese Society of Pediatric Endosurgeons (JSPE). Since JSPE includes the fields of pediatric anesthesiology, urology, and cardiovascular surgery, we believed that this would capture most of the endosurgical procedures for pediatric malignancies performed in Japan. Of the 61 institutions that responded to the questionnaire, only 29 had experience with endosurgical procedures, and had performed 129 endosurgical procedures between them. None of the institutions reported any incidence of PSR after endosurgical procedure for pediatric malignancy, although 7 cases of local recurrence were reported (Table 4). For the most common disease, neuroblastoma, 104 endosurgical procedures were performed but only one case had local recurrence in the lymph nodes after laparoscopic excision (Tables 3, 4).

Spontaneous regression and maturation is a common phenomenon of neuroblastoma detected by mass-screening of 6-month-old infants [5, 13]. Using a murine model, Iwanaka et al. demonstrated that postoperative administration of high doses of chemotherapy may prevent PSR after endosurgical procedure [4]; however, postoperative chemotherapy is not recommended after complete open excision of early localized mass-screened neuroblastoma, since the risks associated with chemotherapy are much more severe than the surgical stress associated with open procedures. There is no data on PSR following endosurgical excision of early-stage localized neuroblastoma. Although laparoscopic tumor excision has certain advantages, conventional open surgery is recommended for removal of mass-screened localized neuroblastoma [3].

It is very important to survey the incidence of PSR with, and without postoperative chemotherapy after endosurgical excision for early localized neuroblastoma. Of the 68 patients with stage-I and stage-II neuroblastoma who underwent endosurgical excision of their tumor, 48 (70.6%) did not receive any postoperative chemotherapy, yet no PSR was reported in them (Table 3). Comparison of the incidence of PSR after laparoscopic colectomy (3.9%), and cholecystectomy (17.1%) in adults [8] suggests that PSR after endosurgical procedure for early neuroblastoma is an extremely rare phenomenon. Although PSR did not occur after endosurgical procedure in other pediatric tumors, the number of patients for each tumor type was too few for the results to be decisive.

## Conclusion

We conclude that both, laparoscopic and thoracoscopic procedures, are safe and recommended for treating pediatric malignancies, especially early localized neuroblastomas. If histopathological and biological evaluation of endosurgically removed neuroblastoma reveals poor prognosis, high-dose postoperative chemotherapy should be administered even in the case of early-localized neuroblastoma.

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