LONG-TERM FOLLOW-UP RESULTS OF SINGLE PORT LAPAROSCOPIC RIGHT HEMICOLECTOMY

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ABSTRACT

Objectives: *evaluation of feasibility, safety, and outcomes of single port laparoscopic surgery (SPLS) for right hemicolectomy. Prospective study of 84 patients suffering from right colon cancer who underwent SPLS between December 2010 and December 2016 and were followed up until December 2017 in Hue Central Hospital.*

Results: *Mean age of patients was 56.3 ±16.2 (25-87) years, fifty-five (64,28%) were males. Mean BMI was 24.2±5.3kg/m^2. mean ASA score for all patients was 2.7 (1–3). Ten cases (11.9%) required additional ports in which 6 were finally converted to open surgery. There were no deaths as well as intraoperative complications. Mean tumor size was 4.4±3.6 (3-8 cm). For successful operated group with SPLS, mean operation time was 135.5±23.2 minutes. Blood loss was 54± 22 ml. Mean incisional length (including extension for extraction) was 4.6±3.5cm. Mean lymph nodes harvest was 14.2±0.8. Stage I: 13.5%; stage II: 35.1%; stage III: 51.4%; Postoperative pain was 4 points at day 0. The surgical site infection rate was 2.7%. Mean hospital stay was 6.3±3.4 days. There was one anastomotic leakage in open conversion group. Mean follow-up period was 41.5 months (12-84 months). There were 7 local recurrences, 4 patients developed liver metastasis and 1 lung metastasis. The overall survival time of all stages was 96.2% (24 months); 92.8% (36 months) and 75.7% (60 months).*

Conclusion: *SPLS for right hemicolectomy is feasible and safe. The cosmetic value is better (short incision confounded by umbilicus). Other outcomes were equivalent to conventional laparoscopy.*

Keywords*: right colon cancer; single port laparoscopic surgery.*

I. INTRODUCTION

Single port laparoscopic surgery (SPLS) is a recent addition to the minimally invasive in treatment of colorectal cancer. This novel approach was used and described for resection of the right colon by both Bucher et al and Remzi et al in 2008.

SPLS presents a number of potential benefits. The most obvious benefit relates to the cosmesis due to a reduction in number of abdominal incisions. In addition, reductions in postoperative pain and morbidity rate compared with conventional laparoscopy were showed by several authors.

However, a number of possible drawbacks to implementing this technique exist, including

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- Received: 8/8/2018; Revised: 16/8/2018
- Accepted: 27/8/2018

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difficulty in exposure and visualization, increased operative time, compromised oncologic outcome and patient safety.

Our aim is to appreciate whether this approach can be adopted in a safe and efficacious manner while using standard laparoscopic instrumentation.

II. METHODS

Consecutive selected patients with right colon cancer who gave informed consent for single port laparoscopic right hemicolectomy were included. All underwent operation at Hue central hospital. Hospital ethics committee approval was obtained for this cohort study.

The study period of interest was between December 2010 and December 2017. Patients' selection for study will be stopped from December 2016. During this period, all patients with tumors ≤6 cm (Tumor' length measured on CT scan), T1-3, no distant metastasis on thoracic and abdominal CT-scan, ASA fitness grade I-III, not overweight (BMI below 25 kg/m^2) were included. Patients undergoing urgent or emergent colectomy, or those with T4 tumors, were excluded.

Surgical technique

Preoperative preparation was similar to that for conventional laparoscopic right hemicolectomy. Underwent general anesthesia, the patient was placed in the supine position with insertion of bladder catheter. Surgical team was on the patient'left.

A longitudinal incision through the umbilicus (2-2.5 cm) was made and a SILS port multiple access port (Covidien Minneapolis) was placed; Standard laparoscopic graspers was used along with a 30º telescope (5.5 mm, 50 cm) and Harmonic scalpel (Ultracision, Ethicon).

The operative procedure was the same between single port and standard laparoscopy. The dissection was performed in a medial to lateral fashion. The ileocolic pedicle and then right colic artery were ligated close to its origin by hem-o-lok® clips (Weck Closure Systems, Research Triangle Park, North Carolina, USA). The right colon and the proximal transverse colon were mobilized. The right branch of middle colic artery was divided. The specimen was exteriorized through the enlarged umbilical incision covered by a wound protector. An ileocolic side-to-side anastomosis was then made. The bowel was returned into the abdomen and the operation was completed by the laparoscopic reexamination.

In case of difficulty, one or more ports might be added or might be converted to open surgery if additional ports could not resolve the problem.

Assessment and analysis

Patients' general characteristics, rate of port (s) addition or conversion to laparotomy were recorded. Patients were divided into 3 groups: SPLS, addition port and open conversion for analysis of intra-operative events, postoperative complications, postoperative pain at rest, specimen pathology, hospital stays as well as survival rates. Postoperative pain was evaluated by means of a visual analogue scale (VAS) as soon as the patient is completely awake. The standard pain therapy was intravenous paracetamol (60 mg per kg per 24h), given after pain evaluation. Specimen pathology was analysed about tumor size, tumor grade as well as number of harvested ganglions and number of positive ganglions.

Patient data are shown as mean (s.d.) unless indicated otherwise.

III. RESULTS

From December 2010 to December 2016, Eighty-four single port laparoscopic right hemicolectomy were performed. The mean age was 56.3 ±16.2 (25-87) years. Fifty-five (65.5%) were males. The mean BMI was 24.2±5.3 kg/m^2. There were no patients undergone prior abdominal operation. The mean ASA score was 2.7 (1–3). All of patients underwent resection for adenocarcinoma.

The mean tumor size was 4.4±3.6 (3-8) cm.

One port addition in lower right quadrant occurred in 10 cases (11.9%) in which 6 cases (7.1%) were finally converted to open surgery. The reasons for those were peritumoral inflammation 2 (2.4%) cases and tumoral invasion 8 (9.5%) cases. The operative results of three groups were showed in table 1 and post-operative pain assessment was in Figure 1.

Table 1: Operative results

Parameters	Single port n=74(88.1%)	Add port n=4(4.7%)	Open conversion n=6(7.1%)	p-value (*)
Operating time (minutes)	135.5±23.2	147.5±25.0	201.7±38.7	<0,0001
Blood loss (ml)	54 ± 22	65 ± 2	54 ± 22	-
Incisional length (cm)	4.6±3.5	5.8±0.9	17.5±17.5	< 0,0001
Bowel movement return (days)	3.2±3.5	3.8±0.9	4.5±1.1	-
Hospital stay (days)	6.3±3.4	10.5±6.4	11.7±6.6	0,0009
Incisional infection (%)	2 (2.7)	1 (25.0)	0	-
Anastomotic leakage (%)	0	0	1 (16.7)	-

(*) p-value is compared between single port and open conversion group

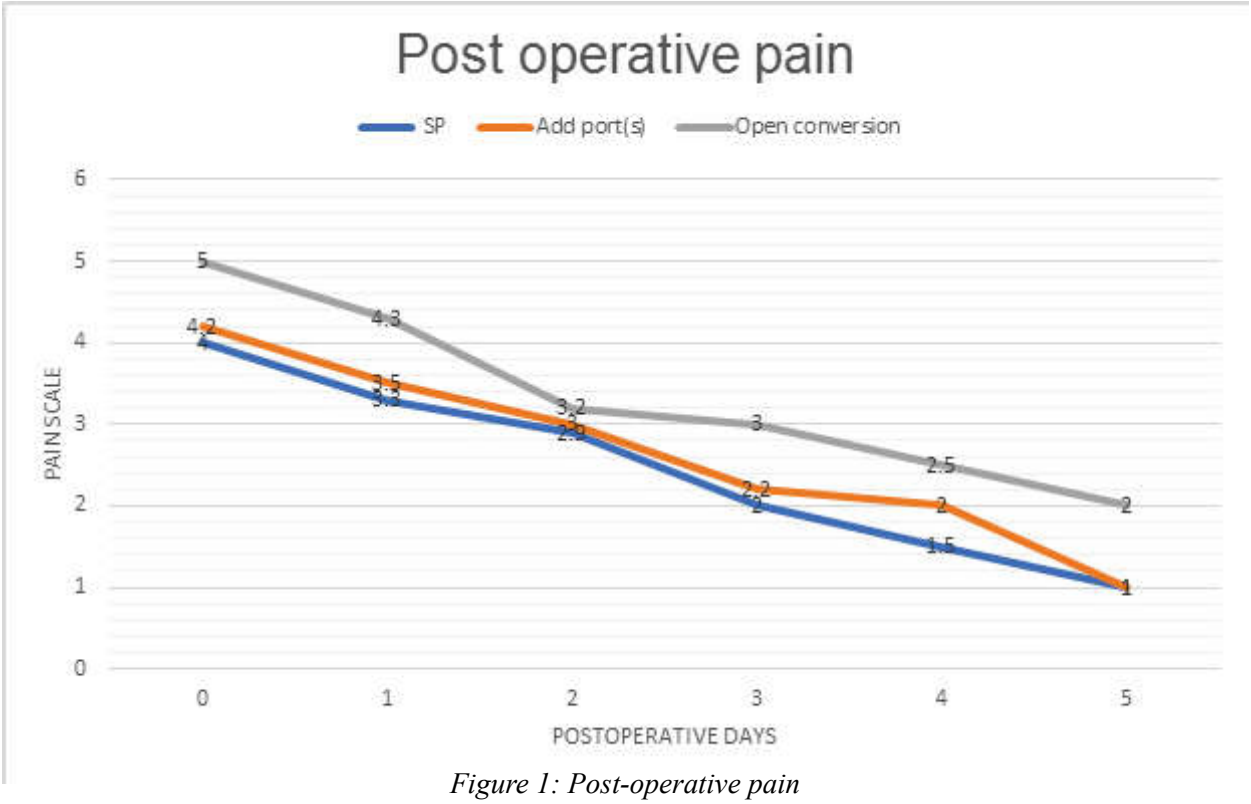

Figure 1: Post-operative pain

P<0.003 (Single port vs Open conversion group)

P>0.05 (Single port vs Addition port(s) group)

Anatomo-pathologic analysis showed that the extent of resection with the mean length was 24 ± 4,5. The post-operative Staging and lympho-node harvest were showed in table 2 and 3.

Table 2: Post-operative staging

Stage	Single port (n=74)	Addition Port (n=4)	Open conversion (n=6)
Stage I	10 (13.5%)	0	0
Stage II	26 (35.1%)	1 (25.0%)	1 (16.7%)
Stage III	38 (51.4%)	3 (75.0%)	5 (83.3%)
Stage IV	0	0	0

Table 3: Lympho-node harvest

Group	Single port (n=74)	Addition Port (n=4)	Open conversion (n=6)
Lymphonode harvest	14.2±0.8	15.7±0.9	16.8±1.2

Mean time follow-up 41.5 (12-84) months. The postoperative follow-up was detailed in table 4.

Table 4: Postoperative follow-up

	Single port (n=74)	Addition port (n=4)	Open conversion (n=6)
Liver metastasis	3 (4.1)	1 (25.0)	0
Local recurrence	5 (6.8)	0 (0)	2 (33.3)
Lung metastasis	0 (0)	0 (0)	1 (16.7)
Incisional hernia	1 (1.4)	0 (0)	0
Incisional metastasis	0 (0)	0 (0)	0

Overall survival of all patients in study and each group were showed in figure 2 and figure 3

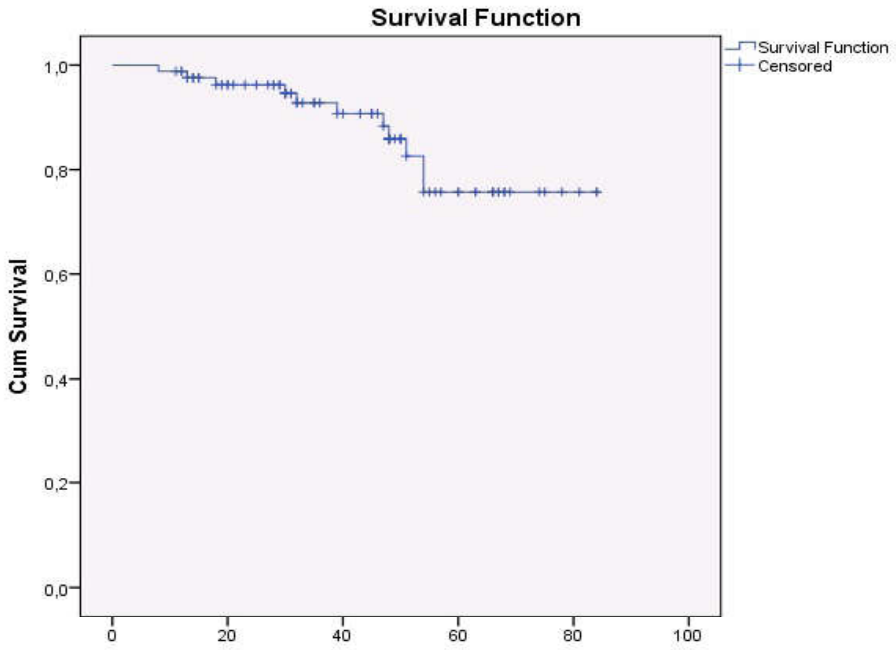

Figure 2: Overall survival (Kaplan_Meier) of all patients

Survival for 84 patients

(24 months 96.2%; 36 months 92.8% and 60 months 82.6%)

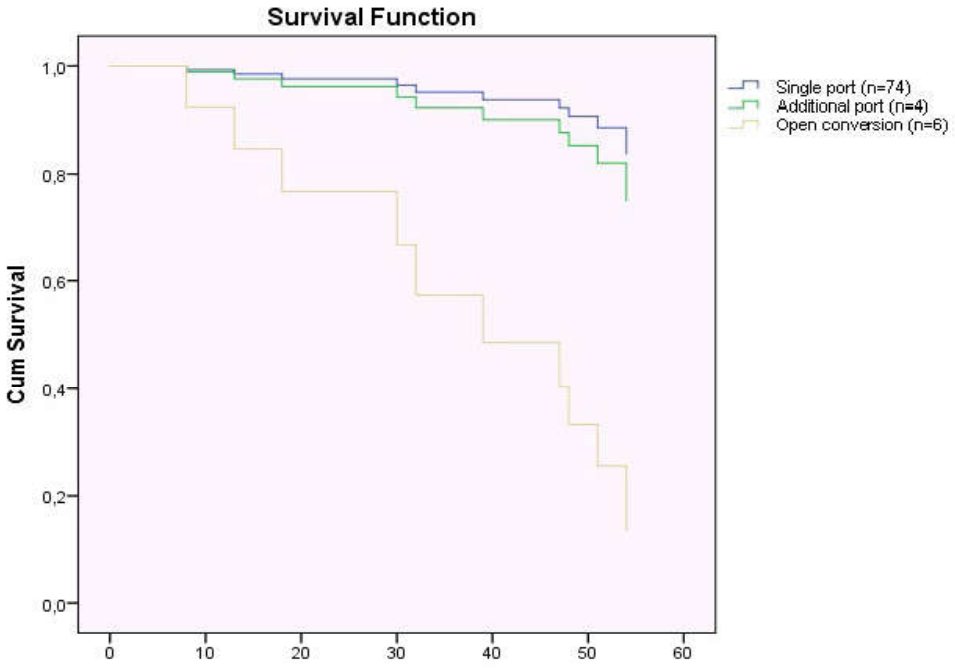

Figure 3: Overall survival (Kaplan Meier) of each group

Single port: 24 months 98.1%; 36 months 93.5% and 60 months 83.2%

Addition port: 24 months 96.5%; 36 months 91% and 60 months 66.7%

Open conversion: 24 months 78.2%; 36 months 50.0% and 60 months 25.0%

IV. DISCUSSION

Even though we had difficulty in performing the SPLS, this study with 84 consecutive patients undergoing SPLS without deaths and intra-operative complications, only one anastomotic leakage showed that SPLS for right hemicolectomy for cancer was feasible and safe.

Indeed, SPLS with traditional instruments has made us difficult to perform due to the visual field and the instruments being parallel. In addition, limited surgical field leads to clash between the working instruments. We used a scope 5 mm 30 º with the length 50 cm (longer than working instruments 35 cm) and dissection with cross instrument technique to reduce the impact of this problem. However, in some cases due to insufficient tension, monopolar device met difficulty in dissecting, using harmonic scalpel was our solution in this situation. Most published studies have proved the feasibility and safety of right SPLC.

This study had 11,9% cases with additional port in right lower quadrant and 7.1% converted cases. The reasons for those were peritumoral inflammation 2 (2.4%) cases and tumoral invasion 8 (9.5%) cases. Although BMI in this study was 24.2±5.3 kg/m^2, we didn't think overweight affected the conversion rate. However, it is well recognized that this is one of the factors that leads to the conversion from SP laparoscopy to conventional laparoscopy or laparotomy because mesenteric blood vessel cannot be seen easily. Diego I., et al. also found the conversion rate was higher in the group with BMI over 25 kg/m^2 compared to the group with BMI less than 25 kg/m^2 .

Conversion rate of this study was higher than several studies although the BMI was similar between these studies. This was probably due to 12% tumors with peritumoral inflammation or tumoral invasion making some tumors larger in this study although mean tumor size of this study was 4.1±4.6. (3-8 cm).

The operating time of this study (table 1) was similar with our previous study of standard laparoscopic hemicolectomy for cancer. In some studies, operating time for SPLS was longer than conventional laparoscopy. However, according to William T., et al., SP laparoscopy should be performed by experienced surgeons in laparoscopic surgery, and when this technique becomes routine, the time factor is no longer different between the two techniques.

Besides, this study showed that the operating time was longer significantly in open conversion group ($p<0.0001$), but non-significantly in addition port(s) group (table 1). We have also noted so for the hospital duration and postoperative pain (table 1). Therefore, careful selection to avoid having open conversion was important. We noted that most patients in open conversion group were in stage III (table 2).

The average incision length of this study (table 1) was similar with those of studies of Keshava A., et al and William T., et al. With such length, the incision was almost hidden by the umbilicus.

In terms of safety, this study had two cases of wound infection and there was no anastomotic leakage in SPLS group. But there was one anastomotic leakage in open conversion group. Low rates of complications were also reported in other studies.

In terms of oncology, the number of lympho-node harvest in this study met the oncologic requirement that was over 12 lymph nodes harvest in SP group. The difference in lympho-node harvest between three groups was not significative (table 3).

With mean follow-up period 41.5 (12-84) months, the local recurrences, liver metastasis and lung metastasis (table 4) was similar with our previous study of standard laparoscopic hemicolectomy for cancer[14]. Local recurrence and metastasis occurred with higher rate (33.3% and 16.7%) in open conversion group (table 4).

The three years survival rate of all groups was 92.8%, and 82.6% by 5 years. These results were similar with the study about standard laparoscopic right hemicolectomy of Joon Hoon Cho[15] and our previous study.

V. CONCLUSION

SPLS for right hemicolectomy is feasible, and safe. The cosmetic value is better (shorter incision, hidden by umbilicus). Other results are similar to conventional laparoscopy.

However, a large number of patients are required for accurate assessment of the long-term results, particularly in terms of oncology.

AUTHOR DISCLOSURES

None of the authors have any conflicts of interest or financial ties to disclose.

Acknowledgements: we thank the doctors François Lacaine and Abe Fingerhut for their assistance.

All data and materials have been made publicly available at the archiving medical record room of Hue central hospital.

REFERENCE

1. Bucher P, Pugin F, Morel P. Single port access laparoscopic right hemicolectomy. *Int J Colorectal Dis.*2008; 23:1013–1016.
2. Remzi FH, Kirat HT, Kaouk JH, Geisler DP. Single port laparoscopy in colorectal surgery. *Colorectal Dis*. 2008; 10:823– 826.
3. Tsimoyiannis EC, Tsimogiannis CK, Pappas-Gogos G, et al. Different pain scores in single transumbilical incision laparoscopic cholecystectomy versus classic laparoscopic cholecystectomy: a randomized controlled trial. *Surg Endosc.* 2010; 24:1842–1848.
4. Takemasa I, Sekimoto M, Ikeda M, Mizushima T, Yamamoto H, Doki Y, Mori M (2010) Video.

Transumbilical single-incision laparoscopic surgery for sigmoid colon cancer. Surg Endosc 24:2321.

5. Diego I, Ramos V, Chirag B. P (2010), Single-incision laparoscopic right hemicolectomy: safety and feasibility in a series of consecutive cases, *Surg Endosc*, 24, pp.2613–2616.
6. Boni L, Dionigi G, Cassinotti E, Di Giuseppe M, Diurni M, Rausei S, Cantore F, Dionigi R. Single incision laparoscopic right colectomy. *Surg Endosc* 2010; 24: 3233-3236 [PMID:20464415 DOI: 10.1007/s00464-010-1100-4]
7. Keshava A, Young C.J and Mackenzie S (2010), Single-incision laparoscopic right hemicolectomy, *British Journal of Surgery*, 97, pp.1881–1883.
8. Peter B, Van den B, Colin S (2011), Single-Incision Laparoscopic Colorectal Surgery, Experience with 50 Consecutive Cases, *J Gastrointest Surg*, 15, pp.1989–1994.
9. Chen W.T, Chang S.C, Chiang H.C, Lo W.Y, Jeng L.B, Wu C, Ke T.W (2011), Single-incision laparoscopic versus conventional laparoscopic right hemicolectomy: a comparison of shortterm surgical results. *Surg Endosc*; 25: 1887-1892 [PMID:21359907 DOI: 10.1007/s00464-010-1481-4]
10. Tsujinaka S, Konishi F, Kawamura Y.J, Saito M, Tajima N,Tanaka O, Lefor A.T (2008), Visceral obesity predicts surgical outcomes after laparoscopic colectomy for sigmoid colon cancer. *Dis Colon Rectum*; 51: 1757-165; discussion 1757-165;[PMID: 18600376 DOI: 10.1007/s10350-008-9395-0]
11. Makino T, Milsom J.W, Lee S.W (2012), Feasibility and safety of single-incision laparoscopic colectomy: a systematic review. *Ann Surg*; 255: 667-676 [PMID: 22258065 DOI:10.1155/2012/783074]
12. William T, Liang C, Sheng C.C (2011), Single-incision laparoscopic versus conventional laparoscopic right hemicolectomy: a comparison of short-term surgical results, *Surg Endosc*, 25, pp.1887–1892.
13. Fung A.K, Aly E.H (2012), Systematic review of single-incision laparoscopic colonic surgery. *Br J Surg*; 99: 1353-1364 [PMID:22961513]
14. Thien Ho Huu, Hiep Pham Nhu, Vu Pham Anh, Thanh Phan Hai, Xuan Nguyen Thanh, Trung Tran Nghiem, Vy Pham Trung (2012), Results of laparoscopic right colectomy for cancer, *Vietnam journal of Endolaparoscopic surgery* 2(1), pp.115-118.
15. Jung Hoon Cho, Dae Ro Lim, Hyuk Hur, Byung Soh Min, Seung Hyuk Baik, Kang Young Lee, Nam Kyu Kim. Oncologic Outcomes of a Laparoscopic Right Hemicolectomy for Colon Cancer: Results of a 3-Year Follow-up. *J Korean Soc Coloproctol* 28(1): 42-48