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Secretariat Office :

Royal Golden Jubilee Building, 2 Soi Soonvijai, New Petchaburi Road, Huaykwang, Bangkok 10310, Thailand
Tel. +66 2716 6141-3 Fax +66 2716 6144 E-mail: Journal.TJS@gmail.com www.tci-thaijo.org/index.php/ThaiJSurg/index



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The Committee on Enzymes of the Scandinavian Society for Clinical Chemistry and Clinical Physiology. Recommended method for the determination of gamma glutamyltransferase in blood. *Scand J Clin Lab Invest* 1976; 36:119-25.

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7. Agency Publication:

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9. Magazine Article:

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Abbreviations

Use only standard abbreviations of commonly used approved abbreviations. Avoid abbreviations in the title. The full term for which an abbreviation stands should precede its first use in the text unless it is a standard unit of measurement.

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Original Article

Right Ventricular Outflow Tract Reconstruction Using Transannular Patch with Pericardial Monocusp in Patients with Tetralogy of Fallot

Nisit Poolthananant, MD*

Teera Hemrungrrote, MD*

Prapat Ausayapao, MD†

Jitrawee Disrattakit, MD†

Ketsarin Sirichuanjun‡

Damri Sethachinda, MD*

* Cardiothoracic Unit, Department of Surgery, Maharat Nakhon Ratchasima Hospital, Nakhon Ratchasima, Thailand

† Cardiology Unit, Department of Pediatrics, Maharat Nakhon Ratchasima Hospital, Nakhon Ratchasima, Thailand

‡ Doctoral candidate, Department of Epidemiology and Biostatistics (International Program), Faculty of Public Health, Khon Kaen University, Thailand

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Abstract

Background: Tetralogy of Fallot is the most common cyanotic heart disease in Thailand. Many patients have stenosis involving the pulmonic valve (PV) annulus which requires complex surgical procedures to relieve the obstruction at this level, especially by using a transannular patch (TAP). We analyzed the early results of TAP with pericardial monocusp, and compared this with the results of non-TAP operations.

Methods: A retrospective medical record review was conducted which included 69 patients who underwent definitive cardiac repair between January 2009 to December 2018. The results of patients who underwent TAP with the pericardial monocusp technique were compared to those who underwent the non-TAP technique.

Results: There were 30 patients in the non-TAP group (mean age 92.6 months) and 39 patients in the TAP group (mean age 90.4 months). Most patients in both groups had favorable and comparable preoperative characteristics, except the mean PV annulus diameter in the TAP group was smaller than that in the non-TAP group (mean z-score in the TAP group, -2.2, in the Non-TAP group, 0.6, p -value < 0.001). Bypass times were longer in the TAP group (non-TAP group 107 ± 42 mins, TAP group 138 ± 37 mins, p -value 0.002). Cross-clamp times were longer as well (Non-TAP group 79 ± 27 mins, TAP group 102 ± 27 mins, p -value 0.001). In-hospital mortality rate was higher in the TAP group (Non-TAP group 7%, TAP group 23%).

Correspondence address: Nisit Poolthananant, MD, Cardiothoracic Unit, Department of Surgery, Maharat Nakhon Ratchasima Hospital, 49, Chang Phueak Rd, Mueang District, Nakhon Ratchasima; Tel.: +660 4423 5469, Fax: +660 4424 6389; E-mail: joenisit@gmail.com

Overall survival was 88.4 % at 2 years (96.7% in non-TAP group, and 82.1% in TAP group). After exclusion of in-hospital deaths from both groups, freedom from at least moderate pulmonary stenosis or regurgitation at 2 years was 93.3 % in the non-TAP group, and 61.1 % in the TAP group, whereas freedom from re-intervention was excellent and comparable in both groups (Non-TAP group 100%, TAP group 96.4%).

Conclusion: TAP with monocusp technique can adequately relieve PV stenosis with good valvular function at least in the early period after surgery. Although the in-hospital mortality was higher with TAP, increasing experience should eventually reduce the mortality rate.

Keywords: Right ventricular outflow tract reconstruction, Tetralogy of Fallot, Transannular patch, Monocusp

INTRODUCTION

Tetralogy of Fallot (TOF) is the most common congenital cyanotic heart disease in Thailand. Its prevalence is approximately 2% of all congenital heart diseases¹. A surgical program for TOF was established since 2009 at Maharaj Nakhon Ratchasima hospital. Our program was developed to achieve the best outcome for patients with this complicated condition. TOF is a disease consisting of 4 lesions: right ventricular outflow tract stenosis (RVOT stenosis); ventricular septal defect (VSD); overriding of aorta; and, right ventricular hypertrophy. These defects cause difficulty for venous blood to pass from the right ventricle (RV) to the lungs. Venous blood from the RV needs to shunt through the VSD, forcing deoxygenated blood to mix with oxygenated blood before being pumped to the rest of the body, resulting in cyanosis. The severity of the disease depends on the RVOT morphology^{2,3}. Surgical principles for correcting TOF include: (1) eliminating intracardiac shunt (2) reduction of RV pressure and volume load by relieving the RVOT stenosis, and (3) preservation of normal cardiac function. Surgery can be performed in one setting (primary repair). However, if the patient's size is too small for this complex operation, a staged procedure can be used, wherein a palliative procedure can be performed initially followed by definitive repair later in life^{2,4-8}.

The pulmonic valve (PV) separates the RV from the pulmonary artery. Thus, certain pathologies of the pulmonic valve can decrease the amount of blood passing to the lungs and affecting the function of the RV. PV with small annular size is one major risk factor for operative mortality⁹. In 1959, the transannular patch (TAP) technique was developed to enlarge PV annulus to deal with this problem¹⁰. The disadvantage of pure TAP is the inevitable development of postoperative severe pulmonary regurgitation, causing RV volume loading and increasing mortality in this subgroup of TOF

patients, as compared to those with no need for transannular patch^{10,11}. In 1994, a technique adding pericardial monocusp to TAP was developed¹². This technique corrected the problem of pulmonic regurgitation by adding a reconstructed neo-pulmonic valve. In the present study, we analyzed the early outcome of transannular patch with pericardial monocusp at our institution.

MATERIALS AND METHODS

The present study was approved by our institutional review board/research ethics committee. All medical records of patients who underwent definitive repair at our center between January 2009 to December 2018 were reviewed.

Patients with TOF pathophysiology including TOF with pulmonic stenosis (PS) or pulmonary atresia (PA) and double outlet of right ventricle with VSD and pulmonic stenosis (DORV with VSD and PS) were included in the study. All patients underwent definitive repair as a primary procedure or as a secondary procedure after palliative surgery. Patients who underwent palliative surgery alone and who underwent definitive repair using RVOT reconstruction other than the conventional non-TAP or TAP techniques were excluded.

Information retrieved preoperatively included demographic data, results of laboratory investigations, data from preoperative transthoracic echocardiography and cardiac catheterization. PV annulus size and z-scores were calculated using the method described by Boston Children's Hospital Group^{13,14}. The size of pulmonary artery branches was evaluated and represented in terms of the McGoon ratio, which is calculated by summing the right and left pulmonary artery diameters at the point of first branching, and dividing by the diameter of descending aorta at the diaphragmatic level.

Definitive repair was performed under moderate (28°C to 32°C) hypothermic cardiopulmonary bypass

with single-dose cold crystalloid cardioplegia (Histidine-Tryptophan-Ketoglutarate solution). After the heart ceased beating, the VSD was closed trans-atrially using a patch of Dacron or autologous pericardium. RVOT obstruction was relieved by using combined trans-atrial and trans-pulmonary infundibulectomy. If the intraoperative measurement of the PV z-score revealed adequate size, e.g., z-score ≥ -2.0 , the procedure ends at this point. If the PV z scores were less than -2.0 preoperatively or intraoperatively, we proceeded to perform annular enlargement of the PV by using transannular patch with pericardial monocusp augmentation as described by Gundry et al¹².

In summary, the surgical procedures included: (1) infundibulotomy by longitudinal incision extending from RVOT across PV annulus to the main pulmonary artery; (2) preparation of the autologous monocusp by cutting a triangular-shaped piece of pericardium; (3) placement of monocusp by suturing to the edge of the infundibulotomy up to the level of PV annulus. The upper edge of the monocusp was left unattached, so that the monocusp would lie against the posterior wall of the MPA and function as a neo-pulmonic valve. Finally, (4) TAP made from autologous pericardium is placed, which serve as the anterior wall of infundibulotomy and the MPA (Figure 1). The width of the TAP is such that the new PV annulus has a z-score of 0.

Patients were divided into 2 groups depending on

the RVOT management: the conventional, no transannular patch (Non-TAP) group, and the transannular patch with pericardial monocusp (TAP) group. Recorded perioperative and postoperative data included cardiopulmonary bypass (CPB) time; cross-clamp (XCL) time; any additional operations or re-operations in the same admission; the length of ICU stay; the length of hospital stay; and hospital mortality. Evaluation of PV function by echocardiography was performed after the repair.

Follow-up data collected included PV function and any further reinterventions. Reintervention was defined as any procedure performed in order to correct significant pulmonic regurgitation or stenosis after surgery. The procedures included balloon dilatation and re-operative surgery such as repeat transannular patch and pulmonic valve repair or replacement.

Primary outcomes of the study included in-hospital mortality and pulmonic valve function. Pulmonic valve function was measured via echocardiography in terms of degree of regurgitation/stenosis as recommended by the American Society of Echocardiography^{15,16}. Secondary outcomes included the probabilities of freedom from at least moderate PR/PS, or re-intervention, up to 2 years.

Categorical data were summarized in terms of counts and percentages. Continuous data were summarized in terms of mean, standard deviation (SD), and range.

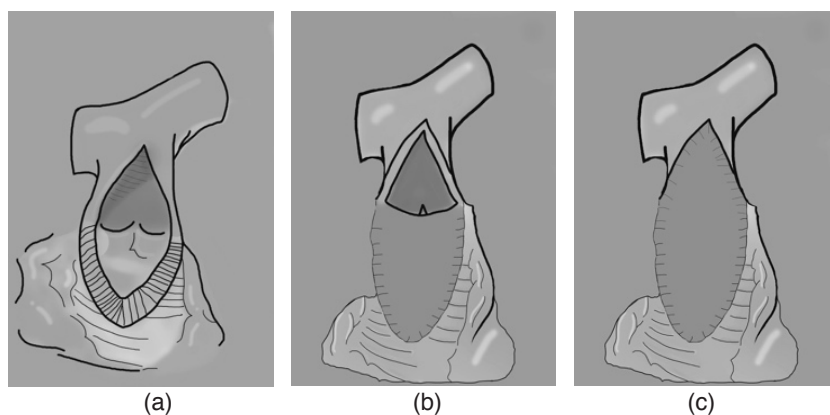


Figure 1 Demonstration of TAP with pericardial monocusp:

- (a) Infundibulotomy by longitudinal incision extending from RVOT across PV annulus to main pulmonary artery
- (b) Preparation of triangular-shaped autologous pericardium (monocusp) and placement by suturing to the edge of the infundibulotomy up to the level of PV annulus. The upper edge of monocusp was left freely mobile, to serve as a neo-valve.
- (c) Placement of TAP to the edge of the infundibulotomy and MPA to serve as the roof.

Comparisons between groups were analyzed by using Student's *t* test for continuous variables and Pearson's Chi-square or Fisher's exact test for categorical variables. The Cox proportional hazard regression was used to determine significant associations between risk factors and outcomes, in terms of hazard ratios (HR) and 95% confidence intervals (CI). Significant *p*-values were defined as 0.05 or less.

RESULTS

There were 79 patients with the diagnosis of TOF or its variants seen during the study period. Ten patients with the exclusion criteria were excluded, leaving a total of 69 patients in the study (Figure 2). Thirty patients underwent repair using the non-TAP technique and 39 patients underwent repair with the TAP technique.

Baseline characteristics are shown in Table 1. Repair of TOF was performed on patients with a mean the age of 74 months. The age at repair was not statistically different between the two groups. Most patients underwent definitive repair when their body weights were at least 15 kg. Approximately 46% of patients had PV z-scores not more than -2.0. The average PV z-scores in the TAP group was significantly less than that in the non-TAP group (-2.2 vs 0.6, *p*-value < 0.001). The prevalence of supravalvular pulmonic stenosis was significantly higher in the TAP group as compared to the non-TAP group (49% vs 3%, *p*-value < 0.001). Both groups had adequate size of pulmonary arteries, with

average McGoon ratios > 2.0 (2.39 in the non-TAP group and 2.26 in the TAP group, *p*-value 0.716). Preoperative hematocrit was higher in the TAP group (48.7 vs 43.8, *p*-value 0.02). There were no statistically differences in RVOT gradient, RV end-diastolic pressure and repair strategy (staged repair or primary repair) between the 2 groups.

Operative times as reflected by CPB times and cross-clamp times, were longer for the TAP group (CPB time in the non-TAP group 107 ± 42 mins, TAP group 138 ± 37 mins, *p*-value 0.002; cross-clamp time in the non-TAP group 79 ± 27 mins, TAP group 102 ± 27 mins, *p*-value 0.001). There were significantly more additional operations in the non-TAP group, but the reoperation rates were not significantly different. The in-hospital mortality rates were 7% in non-TAP group and 23% in TAP group, but these were not statistically different. In the early era of our program (2009 to 2013), the mortality rate was 27%, which decreased to 21% in the later era (2014 to 2018); see Table 2.

Echocardiography was performed on 28 patients in the non-TAP group, and 36 patients in the TAP group. The proportion of patients who still had at least moderate pulmonic stenosis in the TAP group was higher than that in the non-TAP group, but this was of borderline significance. (4% in the non-TAP vs 28% in the TAP group, *p*-value 0.051). The proportion of patients who had no or mild PR in the TAP group was comparable to that in the non-TAP group (Table 3). The average ICU stay was 3.2 days in the non-TAP group and 4.7 days in the TAP group. The average hospital stay was 10.8 days in the non-TAP group vs 12.6 days in the TAP group. Neither the ICU stay nor hospital stay were significantly different between groups (Table 3).

The overall survival was 88.4 % at 2 years for both groups combined. The 2-year survival was 96.7% in the non-TAP group, and 82.1% in the TAP group (Figure 4). After exclusion of in hospital-mortality cases from both groups, the probability of freedom from at least moderate PR or PS at 2 years was 93.3 % in the non-TAP group, and 61.1 % in the TAP group, whereas the freedom from re-intervention at 2 years was 100% in the non-TAP group and 96.4% in the TAP group (Figure 5).

Univariable analysis revealed that possible risk factors for death were PV annulus z-score, RVEDP, primary repair, CPB time, MPA patch plasty and postoperative PS severity.

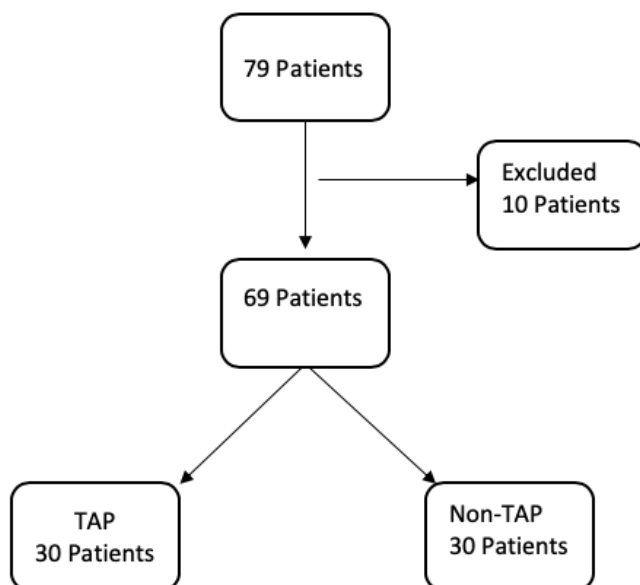


Figure 2 Flow chart of patient enrollment in the study

Table 1 Baseline characteristics of patients

Characteristics		Non-TAP	TAP	p-value
Total number (%)		30 (44)	39 (56)	
Female sex	Number (%)	7 (23)	16 (41)	0.122
Age (Months)	Range	24 to 528	36 to 432	0.916
	Mean	92.9	90.5	
Weight (kgs)	Range	12 to 59	12 to 71	0.927
	Mean	20.4	20.1	
	< 15 kgs: number (%)	9 (30)	11 (28)	
	≥ 15 kgs: number (%)	21 (70)	28 (72)	
Anatomy: number (%)	TOF with PS	25 (83)	29 (74)	0.557
	TOF with PA	0	0	
	DORV, VSD with PS	5 (17)	10 (26)	
PV annulus z-score	Range	-2.8 to 1.97	-4.1 to -0.61	< 0.001
	Mean	0.6	-2.2	
	< -2: number (%)	3 (10)	22 (56)	
	≥ -2: number (%)	24 (80)	16 (41)	
	Unknown	3 (10)	1 (3)	
RVOT gradient (mmHg)	Range	23 to 114	30 to 132	0.879
	Mean	70	71	
	< 70: number (%)	12 (43)	16 (41)	
	≥ 70: number (%)	17 (57)	21 (54)	
	Unknown	1	2	
Right ventricular end-diastolic pressure (mmHg)	Range	0 to 24	1 to 14	0.070
	Mean	7	6	
	< 7: number (%)	9 (30)	14 (36)	
	≥ 7: number (%)	21 (70)	12 (31)	
	Unknown	0	13	
McGoon Index	Range	1.2 to 4.0	1.3 to 3.3	0.716
	Mean	2.39	2.26	
	< 2: number (%)	6 (20)	9 (23)	
	≥ 2: number (%)	24 (80)	29 (74)	
	Unknown (n) (%)	0	1	
Supravalvular PS	Yes: number (%)	1 (3)	19 (49)	< 0.001
	No: number (%)	28 (97)	20 (51)	
	Unknown	1	0	
Chromosomal abnormality	Yes: number (%)	0	0	
	No: number (%)	29 (100)	38 (100)	
Preoperative Hct (%)	Range	34.9 to 69.1	31.3 to 70.2	0.020
	Mean	43.8	48.7	
Strategy of Repair: number (%)	Staged repair	10 (33)	19 (49)	0.199
	Primary repair	20 (67)	20 (51)	

Table 2 Operative data

Variable	Non-TAP N = 30	TAP N = 39	p-value
Bypass time, minutes: mean ± SD (range)	107 ± 42 (60 to 277)	138 ± 37 (84 to 285)	0.002
Cross-clamp time, minutes: mean ± SD (range)	79 ± 27 (42 to 162)	102 ± 27 (50 to 172)	0.001
Additional operation: number (%)	14 (47)	5 (13)	0.002
Pulmonic valve commissurotomy	4 (13)	0	
Supravalvular patch plasty	9 (30)	3 (8)	
Branch pulmonary arterioplasty	0	1 (3)	
Aortic valve repair	1 (3)	1 (3)	
Reoperation: number (%)	3 (9)	3 (8)	0.736
Bleeding	0	1 (3)	
Tamponade	1 (3)	0	
Chest exploration for blood clot	1 (3)	0	
Closure of residual VSD	1 (3)	2 (5)	
Operative death: number (%)	2 (7)	9 (23)	0.065
2009 to 2013	1/15 (7)	3/11 (27)	
2014 to 2018	1/15 (7)	6/28 (21)	

Table 3 Post-operative data

Variable	Non-TAP N = 28	TAP N = 36	p-value
Presence of PS: number (%)	21 (75)	27 (75)	0.999
None	7 (25)	9 (25)	
Mild	20 (71)	17 (47)	
Moderate	1 (4)	8 (22)	
Severe	0	2 (6)	
Presence of PR	15 (54)	26 (72)	0.123
None	13 (46)	10 (28)	
Mild	12 (43)	21 (58)	
Moderate	3 (11)	3 (8)	
Severe	0	2 (6)	
Length of ICU stay, days: mean ± SD (range)	3.2 ± 3.3 (1 to 17)	4.7 ± 5.1 (1 to 23)	0.166
Length of Hospital stay, days: mean ± SD (range)	10.8 ± 5.6 (4 to 17)	12.6 ± 7.4 (5 to 31)	0.253

On multivariable analysis, only PV annulus z-score < -2.0 (adjusted hazard ratio 3.63, *p*-value 0.017) and postoperative moderate to severe PS (adjusted hazard ratio 4.00, *p*-value 0.042) were significant, independent risk factors.

DISCUSSION

TOF remains one of the most common cyanotic

congenital heart diseases in Thailand¹. Care of patients with this disease requires a significant number of financial resources. Surgical treatment aiming at anatomical correction is the mainstay, and life-long follow up due to possible recurrence of symptoms or complications after treatment is required¹⁷.

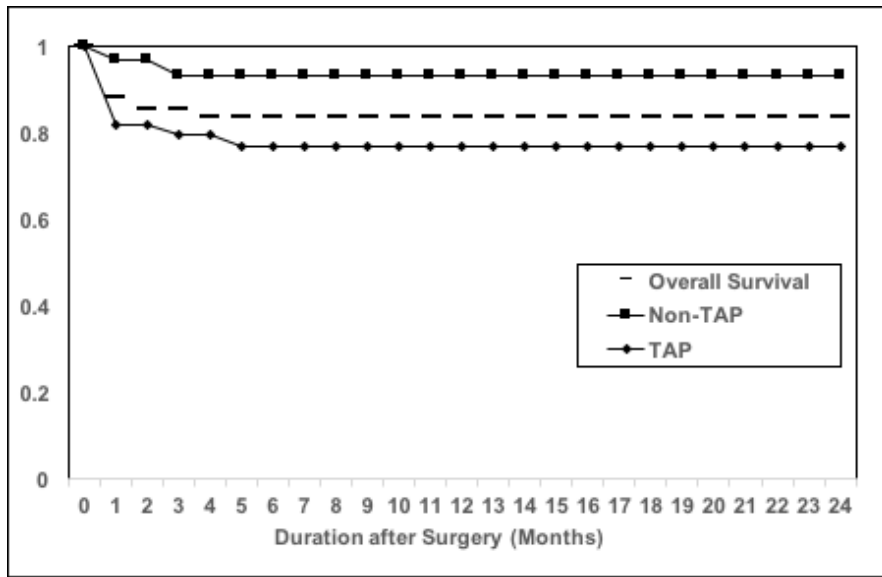


Figure 3 Survival after surgery

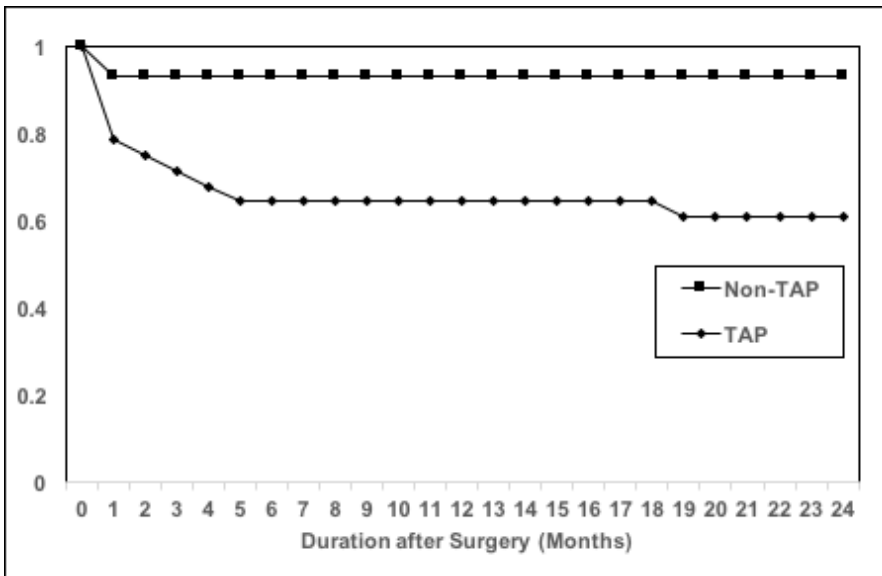


Figure 4 Freedom from at least moderate pulmonic stenosis or pulmonic regurgitation within 2 years

Lilliehei *et al* reported the first successful repair of TOF in 1955⁷. Kirklin *et al* developed a TAP technique to treat TOF with small PV annulus for the first time in 1959¹⁰. This technique effectively relieves obstruction at the valvular level. However, inevitable severe regurgitation occurs due to the requirement of breaking the pulmonic valve integrity when incising across the valve.

The deleterious effects of acute PR occurring after the surgery were demonstrated by clinical and experimental studies¹⁸. Chronic effects of PR were demonstrated in many studies as well¹⁹⁻²¹. One solution

to this problem is to reconstruct a new, competent valve in addition to PV annular enlargement. Another solution is the replacement of RV-pulmonary artery conduit by homografts or xenografts. However, the scarcity, cost and durability are limitations of this latter option in our country. Gundry *et al* in 1994 developed TAP with a monocusp by using autologous pericardium for the first time¹². The technique uses the patient's own pericardium to create a neo-valve with reasonable durability which greatly reduces mortality and improves survival after repair.

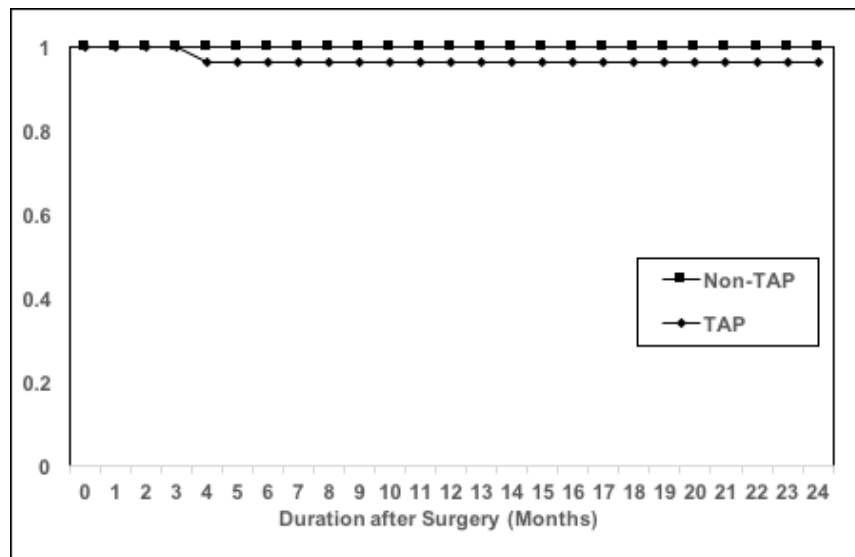


Figure 5 Freedom from re-intervention within 2 years

There is no general consensus on the indication for TAP, in terms of PV annulus size. Generally, z-scores between -2.0 to -3.0 have been used as a surrogate for inadequate PV. However, a study by Mark *et al* showed that even with a PV z-score of -1.3, there could be a 25% chance of significant pulmonic stenosis if TAP were not performed²². The proportion of patients with PV annulus z-score of -2.0 or less was quite high in our study (46%), implying that TAP was probably indicated for these patients.

There are some drawbacks with this technique. TAP with monocusp requires longer operative time as shown by an increase in CPB time and cross-clamp time, which might adversely affect cardiac function. There was a higher rate of moderate to severe pulmonic stenosis in our study. Theoretically, TAP should be able to relieve all stenosis at the pulmonic valvular level, but if the construction of TAP with monocusp is not correctly performed, it can result in inadequate relief of stenosis. Moreover, if the monocusp does not have good competence, significant PR may result. The worst-case scenario is to have both significant PS and PR. This produces both pressure load and volume load to an already thick, non-compliant hypertrophic RV which can progress to postoperative RV failure. This was a major cause of in-hospital deaths in our study.

From the beginning of our program, it is our policy that we avoid definitive surgery in small patients. In larger patients, definitive repair without TAP is more likely^{23,24}, so the burden and complications from the

TAP technique can sometimes be avoided. There is no universally accepted cutoff value of body weight to defer definitive surgery, but if the patient is less than 15 kg and symptomatic, we will perform palliative procedures and let the patient grow, deferring definitive repair for later. The strategy of performing palliative procedure before definitive surgery (staged repair) was probably not a risk factor for in-hospital mortality.

The result of TOF repair depends on many factors, especially surgeon's experience and quality of perioperative care. In our study, the result of repair in the non-TAP group was very good. The in-hospital mortality rate was only 7%, when compared to a large study in the early years of TOF repair by Craig *et al* in 1998, which had a mortality of 11%²⁵. But the in-hospital mortality rate of the TAP group was on the higher side (23%). We believe that our results were affected largely by the relative lack of experience, as the number of TOF cases in our institution were not many even though our program has been in place for 10 years. Thus, we have only slowly accumulated the experience of performing the TAP technique. Nonetheless, the in-hospital mortality has been improving in the last few years (down to 21%, from 27%).

The early survival probabilities and the freedom from reintervention of the TAP group were excellent and comparable to those of the non-TAP group. Though the monocusp valve deteriorated with time, as seen by the declining freedom from at least moderate PR or PS to 61% at 2 years, the monocusp still functioned adequately

enough such that reinterventions in the first few years were still mostly unnecessary. Our results were similar to those of previous studies, which demonstrated excellent valve function in the early period after surgery^{12,26-27}. Therefore, we continue to perform the TAP with monocusp technique. In more recent reports, the surgical mortality rate was between 0 to 3% for all patients, and this should be the goal of all centers performing TOF repair¹⁷.

In terms of predictors of in-hospital mortality, only two factors were identified as significant predictors in our study. The PV z-score <-2.0 seems to be an indirect factor, since this cutoff was an indication to perform TAP, and TAP itself increased the risk of mortality. Postoperative moderate to severe PS is unquestionably a true risk in itself, as demonstrated in the study by Kirklin *et al.*²⁸

A limitation of the present study is the retrospective design, which is prone to confounding and selection biases. Furthermore, the number of patients in our study was small and the follow-up time was short, reducing the likelihood of detecting significant differences between the TAP and non-TAP groups, if they exist. Long-term effects of TAP could not be evaluated at this time, due to the relatively recent establishment of our program and the short follow-up. Future research is required, with more patients and longer follow up.

CONCLUSIONS

The results of the present study showed that the TAP with monocusp technique can adequately relieve PS and PR if correctly performed. The procedure, however, is technically challenging. Adopting this technique requires a dedicated surgical team which might be struggling at first, but the benefits to patients with this complex disease is worth the struggle.

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บทคัดย่อ ผลการรักษาของโรคหัวใจพิการแต่กำเนิดชนิดเขียวเตตราโลจีออฟ ฟาลโลต์ด้วยวิธีการผ่าตัดขยายลิ้นหัวใจร่วมกับการทำลิ้นหัวใจขึ้นรูปเป็น 1 ลิ้น จากเยื่อหุ้มหัวใจ ณ โรงพยาบาลตติยภูมิ นิสิต พุทธนะนันท์, ชีระ เหมรุ่งโรจน์, ประภัสร์ อภัยเผ่า, จิตรวี ดิษฐ์รัฐกิจ, เกษรินทร์ ศิริชวนจันทร์, ดำริ เศรษฐจินดา

ความเป็นมา: โรคเตตราโลจี ออฟ ฟาลโลต์เป็นโรคหัวใจพิการแต่กำเนิดชนิดเขียวที่พบได้บ่อยมากที่สุดในประเทศไทย ผู้ป่วยหลายรายมีการตีบไปจนถึงตำแหน่งลิ้นหัวใจพัลโมนิกพร้อมด้วย ซึ่งต้องการผ่าตัดรักษาที่ซับซ้อนโดยเฉพาะอย่างยิ่งการผ่าตัดขยายลิ้นหัวใจเพื่อแก้ไขการอุดตันในตำแหน่งดังกล่าว คณะผู้ประพันธ์ได้ทำการศึกษาวิเคราะห์เทคนิคการผ่าตัดขยายลิ้นหัวใจร่วมกับการทำลิ้นหัวใจขึ้นรูปเป็น 1 ลิ้น จากเยื่อหุ้มหัวใจ

วิธีการศึกษา: การวิจัยนี้เป็นการศึกษาย้อนหลังซึ่งรวบรวมผู้ป่วยที่ได้รับการผ่าตัดเพื่อแก้ไขทั้งสิ้น 69 ราย โดยเป็นผู้ป่วยที่ได้รับการรักษาตั้งแต่ มกราคม พ.ศ. 2552 จนถึง ธันวาคม พ.ศ. 2561 ผลการรักษาในกลุ่มที่ใช้เทคนิคการผ่าตัดขยายลิ้นหัวใจร่วมกับการทำลิ้นหัวใจขึ้นรูปเป็น 1 ลิ้น จากเยื่อหุ้มหัวใจ (TAP group) ได้นำมาเปรียบเทียบกับในกลุ่มที่ไม่ใช้เทคนิคดังกล่าว (Non-TAP group)

ผลการศึกษา: ผู้ป่วยมีทั้งหมด 30 รายในกลุ่ม Non-TAP (อายุเฉลี่ย 92.6 เดือน) และ 39 รายในกลุ่ม TAP (อายุเฉลี่ย 90.4 เดือน) ส่วนใหญ่ผู้ป่วยทั้ง 2 กลุ่มมีลักษณะเฉพาะที่เหมาะสมก่อนการผ่าตัด ยกเว้นขนาดโดยเฉลี่ยของเส้นผ่าศูนย์กลางลิ้นหัวใจพัลโมนิกในกลุ่ม TAP จะมีขนาดเล็กกว่าในกลุ่ม non-TAP (mean z-score กลุ่ม TAP -2.2, กลุ่ม Non-TAP 0.6, p -value < 0.001). ระยะเวลาที่ใช้เครื่องหัวใจและปอดเทียมระหว่างการทำผ่าตัดในกลุ่ม TAP ยาวนานกว่า (กลุ่ม TAP 138 ± 37 นาที vs กลุ่ม Non-TAP 107 ± 41 นาที, p -value < 0.002) ระยะเวลา Cross clamp ในกลุ่ม TAP ยาวนานกว่าเช่นกัน (กลุ่ม TAP 102 ± 42 นาที, กลุ่ม Non-TAP 79 ± 27 นาที, p -value 0.001) การเสียชีวิตในโรงพยาบาลในกลุ่ม TAP สูงกว่า (กลุ่ม TAP 23%, กลุ่ม Non-TAP 7%) โอกาสรอดชีวิตโดยรวม 88.4% ในช่วง 2 ปีแรก, 96.7% ในกลุ่ม Non-TAP, 82.1% ในกลุ่ม TAP) ภายหลังจากการยกเว้นผู้ป่วยที่เสียชีวิตไปแล้ว พบว่าโอกาสเป็นอิสระต่อการเกิดลิ้นหัวใจพัลโมนิกตีบหรือรั่วในระดับกลางขึ้นไปพบว่าเป็น 93% ในกลุ่ม Non-TAP และ 61% ในกลุ่ม TAP ในขณะที่โอกาสเป็นอิสระต่อการต้องทำมาตรการแก้ไขซ้ำที่ลิ้นหัวใจพัลโมนิกนั้นตีบมาก และพอๆ กันในทั้ง 2 กลุ่ม (กลุ่ม TAP 96.4%, กลุ่ม Non-TAP 100%)

สรุปผลการศึกษา: เทคนิคการผ่าตัดขยายลิ้นหัวใจร่วมกับการทำลิ้นหัวใจขึ้นรูปเป็น 1 ลิ้นสามารถแก้ไขการตีบของลิ้นหัวใจพัลโมนิกได้อย่างเพียงพอ ร่วมกันมีความสามารถป้องกันการรั่วได้ดีในช่วงระยะแรกหลังการผ่าตัด ถึงแม้ว่าการเสียชีวิตในโรงพยาบาลค่อนข้างสูง ด้วยประสบการณ์ที่มากขึ้นย่อมจะทำให้ปัญหานี้ดีขึ้นในที่สุด

Outcome of Early Nutrition Support after Perforated Peptic Ulcer Repair

Punyawat Taweegan, MD

Potipong Reungjui, MD

Department of Surgery, Khon Kaen Hospital, Khon Kaen, Thailand

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Abstract

Background: Early nutrition support (ENS) is safe and beneficial for patients undergoing elective upper gastrointestinal tract surgery. However, the value of ENS in perforated peptic repair remains inconclusive.

Objective: The aim of the present study was to investigate the safety, feasibility, and benefits of ENS in perforated peptic ulcer repair.

Methods: Patients with perforated peptic ulcer who underwent repair by simple closure with omental pedicle techniques were randomized into 2 groups. In the ENS group, patients were given an oral diet of congee at will after 24 hours after repair if gastric residual volume was less than 200 mL per 8 hours. In the traditional postoperative care (TPC) group, patients were given liquid diet progressing to congee at will only after 72 hours. The primary outcome was postoperative complications occurring within 30 days after surgery, including surgical site infection (SSI), hospital acquired pneumonia and postoperative repair leakage. Other outcomes included diet intolerance, time to achieve enteral nutrition in the ENS group and length of hospital stay.

Results: One hundred and ten patients were randomly assigned to TPC or ENS (55 patients per group). Baseline and intraoperative clinical characteristics were similar in both groups. Postoperative complications after surgery were seen in 4.6% of patients. The risk of postoperative complications was slightly higher in the TPC group (3 of 55 patients, 5.5 %) versus the ENS group (2 of 55 patients, 3.6%), but the difference was not statistically significant. Superficial SSI was the only postoperative complication. Neither hospital acquired pneumonia nor postoperative repair leakage were observed. Only one patient in the TPC group had diet intolerance, which was successfully managed conservatively. Time to achieve enteral nutrition in the ENS group was 40 hours (almost 2 days) after surgery. The length of hospital stay was similar for both groups.

Conclusions: ENS in patients who underwent perforated peptic ulcer repair appeared to be as safe as, if not clearly superior to, TPC.

Keywords: Peptic ulcer perforation, Perforated peptic ulcer repair, Early nutrition support, Early enteral feeding

INTRODUCTION

Perforated peptic ulcer is the second most common complication related to peptic ulcer disease and is associated with 30% to 50% morbidity and 10% to 30% mortality. More than 50% of the morbidity is associated with infection². The use of appropriate antibiotics,

adequate fluid resuscitation and early nutrition support can decrease morbidity¹⁷. The current surgical management of perforated peptic ulcer is mainly confined to simple closure with omental pedicle techniques, as a consequence of major advances in the pharmacologic treatment of peptic ulcer disease¹⁸.

Correspondence address: Punyawat Taweegan, MD, Department of Surgery, Khon Kaen Hospital, 54 Srichan Rd., Tambol Naimuang, Amphur Muang, Khon Kaen 40000, Thailand; Telephone: +66 4300 9900 ext. 4472; E-mail: punyawattaweegan@gmail.com

The postoperative care of the patient is still dominated by the long-held belief that traditional postoperative care (TPC), which requires no oral diet for at least 3 days and a progressive oral diet beginning with liquids, would minimize the risk of diet intolerance, repair leakage and pulmonary aspiration¹¹. Even though early nutrition support (ENS) in elective surgery, including non-gastrointestinal, upper gastrointestinal and colorectal surgery, is both beneficial and safe^{13,14,15,19,21}, the value of ENS in emergency surgery, such as in perforated peptic ulcer repair, is still in doubt due to limited evidence⁸. The aim of the present study was to evaluate the safety, feasibility, and benefits of ENS in patients with perforated peptic ulcer.

PATIENTS AND METHODS

The present study was a single-center, randomized, single-blind clinical trial. Patients with perforated peptic ulcer diagnosed between August 25, 2018 to October 20, 2019 were recruited into the study. The Khon Kaen Hospital Institutional Review Board at Khon Kaen, Thailand, approved this study (approval ID: KE61026).

Patients who presented with peritonitis and pneumoperitoneum were provided with sufficiently detailed information about the study and was asked to volunteer and sign an informed consent form. Hospital personnel involved in patients' care were informed of the study. Randomization was done via computer-generated blocks of 4, randomly allocating patients into 2 groups, the ENS group and the TPC group. Allocation was concealed in opaque envelopes, which were opened at the end of the surgical procedure. Patients older than 18 years with perforated peptic ulcer who underwent exploratory laparotomy and repair with simple closure with omental pedicle techniques were included in the study.

Exclusion criteria included preoperative shock on admission, time to operation of over 24 hours, known malignant gastric ulcers confirmed by histopathology, the presence of neuropsychiatric disease, pregnant and lactating women, predisposing factors for impaired wound healing (e.g., currently using immunosuppressive agents, or chronic use of steroids), the presence of HIV/AIDS, and intraoperative findings consistent with malignant ulcers.

Preoperative preparation was identical in both groups and included the insertion of nasogastric tube, urinary catheter, the administration of balanced crystalloid for fluid replacement, intravenous antibiotics with

ceftriaxone (2 grams every 24 hours) and metronidazole (500 mg every 8 hours).

The surgical procedure was done by either the attending staff or a trainee under supervision. Firstly, after exploratory laparotomy, the perforation site was identified by examining the first portion of duodenum and the anterior surface of stomach. If the aforementioned sites were clearly intact, the posterior wall of the stomach and the small bowel were examined. Ulcer biopsy for histopathological examination was mandatory if the ulcer was located at the stomach. Simple closure of the ulcer perforation with omental pedicle technique was the preferred surgical procedure for all cases. This was done by placing 2 or 3 interrupted sutures parallel to the longitudinal axis of the gastrointestinal tract, and an omental pedicle was mobilized and secured over the perforation site with previously placed sutures. The integrity of the repair was tested by filling the stomach with air. If no leak was observed, the peritoneal cavity was irrigated with warm saline. Finally, a Penrose drain was placed at the right subphrenic and subhepatic area, and the abdominal incision was closed.

The nasogastric tube was left in place postoperatively. The urinary catheter was removed on postoperative day 1. Postoperative pain was controlled with morphine (0.1 mg per kilogram, every 4 hours) for the first 2 postoperative days. An intravenous acid – reducing therapy with omeprazole (40 mg every 12 hours) was continued throughout the hospital stay.

In the TPC group, the nasogastric tube was removed 72 hours postoperatively. Oral intake of liquids was started and advanced to congee at will. The Penrose drains were gradually withdrawn every day beginning at 12 hours after initiation of congee.

In the ENS group, the nasogastric tube was removed at 24 hours after operation unless the gastric residual volume was more than 200 mL per 8 hours. Oral intake of congee was started at will. The Penrose drains were gradually withdrawn every day beginning at 12 hours after initiation of congee.

In both groups, oral intake was suspended if the patient was unable to tolerate oral diet. Diet intolerance was defined as postprandial vomiting or abdominal pain (pain score of more than 8 on visual analog scale), and antiemetic drugs were prescribed. If symptoms persisted for over 24 hours, a nasogastric tube was re-inserted. Patients were discharged they were able to tolerate oral diet and defecate, with no drains remaining.

All patients were prescribed oral acetaminophen (500 mg on demand), amoxicillin (2 grams every 12 hours for 14 days), clarithromycin (1 gram every 12 hours for 14 days) and omeprazole (20 mg every 12 hours) for at least 2 months. Patients were advised to have their stitches removed on postoperative day 7 and to return for a follow-up clinical examination on postoperative day 30.

The outcome of the study was the occurrence of 30-day postoperative complications. This included, especially, infection-related postoperative complications such as superficial, deep or organ space SSI, hospital acquired pneumonia, and postoperative repair leakage. Diet intolerance, time to achieve enteral nutrition (especially in the ENS group), and length of hospital stay were also recorded. These complications were defined according to the Clavien-Dindo classification⁶. Postoperative repair leakage was defined as any extraluminal enteric contents detected by drain, at the surgical incision site, or the presence of intraabdominal collection^{4,14}.

The planned sample size per group was estimated using previous information on 30-day postoperative

complications, with a two-sided 5% significance level and a power of 80%. The estimated sample size per group was 250.

Data were collected using data collection forms. These forms were filled by clinicians who were not directly involved in the study, and the collected data were regularly transferred to a computerized database by the researchers.

Categorical variables were compared using the Chi-squared or Fisher's exact test, as appropriate. Student's *t* test, Wilcoxon test or Mann-Whitney U-test was used for continuous data. Statistical significance was defined as a *p*-value < 0.05.

RESULTS

During the study period, there were 205 eligible patients. Ninety-five patients were excluded for various reasons, resulting in 110 patients who were randomized. The CONSORT flow diagram is shown in Figure 1. No randomized patients dropped out of the study or were lost to follow-up. Baseline clinical characteristics and operative findings of patients in both the ENS and TPC groups are shown in Tables 1 and 2.

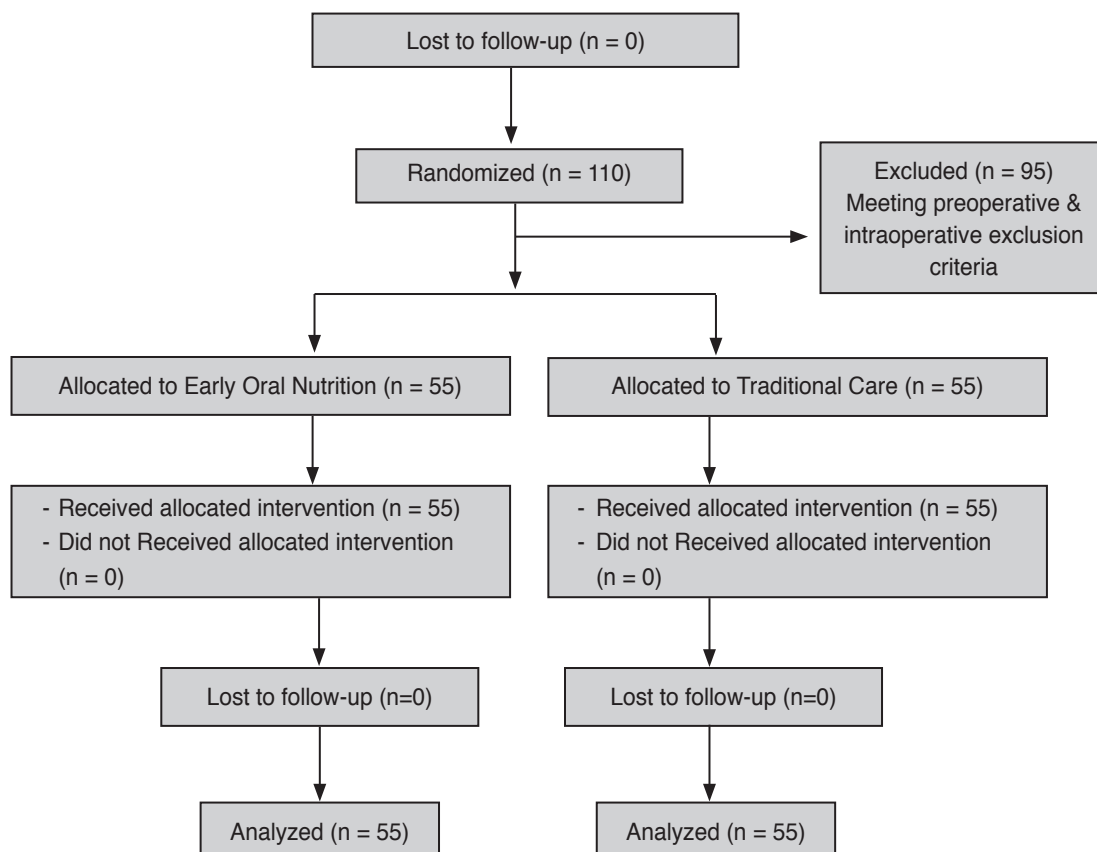


Figure 1 The CONSORT flow diagram for the present study

Table 1 Baseline characteristics of patients in the ENS and TPC groups

	ENS group N = 55	TPC group N = 55
Male: number (%)	51 (93)	50 (91)
Age, years: mean (SD)	58.1 (11.9)	50.6 (15.6)
BMI: median (IQR)	20.8 (19.2, 23.3)	21.3 (20,23)
Underlying disease: number (%)	14 (25)	9 (16)
Diabetes mellitus	2 (4)	4 (7)
Hypertension	6 (11)	7 (13)
Chronic obstructive pulmonary disease	3 (6)	1 (2)
Liver cirrhosis	2 (4)	0
Heart disease	1 (2)	0
Chronic kidney disease	4 (7)	1 (2)
NSAID use: number (%)	39 (71)	38 (69)
ASA class: number (%)		
I	4 (7)	2 (4)
II	32 (58)	41 (75)
III	19 (35)	12 (22)
Smoking: number (%)	32 (58)	31 (56)
Duration before surgery, hours: mean (SD)	13.9 (6.1)	12.2 (4.8)

ENS: Early nutrition support; TPC: Traditional postoperative care; IQR: interquartile range, SD: standard deviation

Table 2 Intraoperative findings of patients in the ENS and TPC groups

	ENS group N = 55	TPC group N = 55
Operative time, minutes: median (IQR)	59 (48,71)	56 (48,81)
Intraoperative diagnosis: number (%)		
Duodenal ulcer	43 (78)	53 (96)
Site of perforation: number (%)		
Prepyloric	6 (11)	1 (2)
Antrum	3 (5)	0
Body of stomach	3 (5)	1 (2)
First part of duodenum	43 (78)	53 (96)
Size of perforation, mm: median (IQR)	5 (3,5)	5 (3,6)
Peritoneal contamination: number (%)		
Clear	1 (2)	2 (4)
Cloudy, purulent	54 (98)	53 (96)
Feculent	0	0
Operative procedure: number (%)		
Graham technique	2 (4)	5 (9)
Cellen-Jones technique	4 (7)	1 (2)
Omentoplasty	49 (89)	49 (89)

ENS: Early nutrition support, TPC: Traditional postoperative care; IQR: interquartile range

Table 3 Comparison between outcomes of patients in the ENS and TPC groups

Outcomes (summarized as number (%), unless stated otherwise)	ENS group N = 55	TPC group N = 55	Risk ratio	95% CI	p-value
Overall complications	2 (4)	3 (6)	1.5	[0.26-8.63]	0.999
Superficial surgical site infection	2 (4)	3 (6)	1.5	[0.26-8.63]	0.999
Organ Space infection	0	0	–	–	–
Hospital acquired pneumonia	0	0	–	–	–
Postoperative repair leakage	0	0	–	–	–
Diet intolerance	0	1 (2)	–	–	0.999
LOH, days: median (IQR)	7 (6,7)	7 (6,8)	–	–	0.052
Time to enteral nutrition in ENS, hours: median (IQR)	40 (36,53)	–	–	–	–

ENS: Early nutrition support; TPC: Traditional postoperative care; LOH: length of hospital stay; IQR: interquartile range

Although there were significant differences between the two groups in terms of age, intraoperative diagnosis, and site of perforation, these were likely due to chance.

Overall, 5 of 110 patients (5%) had postoperative complications after surgery. There were no significant differences in terms of complications between the 2 groups (Table 3). Infection (superficial SSI) accounted for all postoperative complications. Neither hospital acquired pneumonia nor leakage after repair were found. One patient in the TPC group had diet intolerance and responded to conservative treatment. The average time to achieve enteral nutrition in the ENS group was 40 hours after operation (almost 2 days). The median length of hospital stay in the TPC group was 7 days (IQR, 6 to 8 days) versus 7 days (IQR, 6 to 7 days) as well in the ENS group, which were not significantly different (p -value = 0.052). Table 3 details the outcomes of the present study.

DISCUSSION

The present study showed that ENS in patients who underwent perforated peptic ulcer repair did not increase the risk of postoperative complications within 30 days after surgery, although no clear benefit of ENS was demonstrated. However, the present study has several limitations. There were some differences in baseline and intraoperative characteristics of patients between the 2 randomized groups. Blinding the surgeons and patients was not possible for obvious reasons. The study as it currently stands lacked statistical power because the planned sample size has not been reached. But the strength of the present trial included a complete

follow-up with no missing data, and the adherence to the principle of intention-to-treat analysis.

ENS has been shown to be safe, feasible, and beneficial in elective gastrointestinal surgery^{13,14,15,19,21}, but there is a lack of such evidence in the emergency setting. Advantages of early nutrition in emergency gastrointestinal surgery have been suggested. A few RCTs have indicated that early tube feeding in nontraumatic gut perforation might offer advantages with regards to wound complications and hospital stay^{11,12}. Only one RCT has shown that early oral feeding in an Enhanced Recovery Pathway in laparoscopic perforated peptic ulcer repair might provide such advantages⁹. According to a long-held belief, traditional postoperative care in emergency abdominal surgery should prevent anastomotic complications, prevent postoperative ileus and vomiting, and lung aspiration²⁴. The present study aimed to challenge this belief, by examining the safety, feasibility, and benefits of ENS in the emergency setting, specifically in patients undergoing surgery for perforated peptic ulcer.

In the present study, perforated peptic ulcer was more common in men than in women. There was a difference in the mean age between the ENS and TPC groups, but this might not be clinically significant as all patients could be considered middle-aged. There was also a difference in the site of perforation, the duodenum being the more common site in the TPC group (TPC group, 96% versus ENS group, 78%). But because other sites of perforation were almost all located in the prepyloric region, and both prepyloric gastric ulcer and duodenal ulcer share the same pathophysiology of ulcer development,⁵ the difference in location of perforation between the 2 groups should not be clinically important.

The overall postoperative complication rate in the present study was 5%, less than that previously reported in the literature^{8,16}.

A possible explanation might be that high-risk patients were excluded from the present study. The TPC group tended to have a higher risk of postoperative complications, but this was not statistically significant. Perhaps a longer period of routine nasogastric decompression, which has been shown to increase the risk of diet intolerance, lung aspiration, and time to resume oral diet after surgery, might be the explanation for this⁹.

In the present study, all postoperative complications were superficial SSI. A superficial SSI rate of 5% was also less than that reported previously. The wound type for perforated peptic ulcer surgery is regarded as contaminated or dirty, which should have an SSI rate between 15% to 40%⁶. The much lower rate of SSI in the present study could be explained by our excluding high-risk patients, and the extensive use of antibiotics during the perioperative period^{18,23}. None of the patients in both groups developed organ space SSI, hospital acquired pneumonia or postoperative repair leakage. Only one patient in TPC group had diet intolerance. Emergency abdominal surgery, especially in the presence of peritonitis, might account for this. The intestinal mucosa usually heals within 24 hours, but gastrointestinal motility and gastric function mainly return within 24 to 48 hours after surgery. Prolonged nasogastric decompression also increases the duration of diet intolerance, and hence the length of time to resuming oral diet after surgery.

The most appropriate time to start oral feeding in patients under the ENS regimen is 40 hours after surgery, and patients are not expected to have diet intolerance. Perhaps by allowing oral congee only after evidence of a sufficiently low residual gastric volume, which is a good predictor of returning stomach function, we prevented diet intolerance⁷. The length of hospital stay in both groups was 7 days, on average, and this was probably due to the requirement that all peritoneal drains be removed prior to home discharge.

The present study suggests that ENS in perforated peptic ulcer repair does not increase the risk of postoperative complications. However, this might not apply to high risk patients, such as those with late presentation, or with preoperative shock.

CONCLUSION

Early nutrition support in perforated peptic ulcer

repair does not seem to increase the risk of postoperative complications, especially SSI and repair leakage. The appropriate time to start oral nutrition if ENS were to be implemented, to minimize diet intolerance, is 40 hours after surgery. There was no significant difference between ENS and TPC groups in terms of length of hospital stay, which might be because of the requirement to remove all drains before discharge. Thus, while ENS might be as safe as TPC, it might not clearly be more beneficial.

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บทคัดย่อ การเริ่มให้อาหารทางปากเร็วในกลุ่มผู้ป่วยที่ได้รับการผ่าตัดกระเพาะอาหารและลำไส้เล็กส่วนต้น
ทะลุ

ปัญญวัชร ทวีกาญจน์, พ.บ., โภธิพงษ์ เรืองจ้อย, พ.บ.

กลุ่มงานศัลยศาสตร์ โรงพยาบาลขอนแก่น

ความเป็นมา: การเพิ่มให้อาหารทางปากเร็วในผู้ป่วยที่ได้รับการผ่าตัดแบบไม่เร่งด่วน (Elective surgery) ช่วยลดภาวะแทรกซ้อนลงได้ภายใน 30 วัน (Morbidity) โดยเฉพาะภาวะแทรกซ้อนที่มีความสัมพันธ์กับการติดเชื้อ อีกทั้งยังช่วยลดระยะเวลาการนอนโรงพยาบาล แต่ผลของการเริ่มให้อาหารทางปากเร็วในผู้ป่วยที่ได้รับการผ่าตัดฉุกเฉิน (Emergency surgery) โดยเฉพาะภาวะกระเพาะอาหารและลำไส้เล็กส่วนต้นทะลุนั้นยังสรุปได้ไม่ชัดเจน

วัตถุประสงค์: เพื่อศึกษาผลของการเริ่มให้อาหารทางปากเร็วในผู้ป่วยที่ได้รับการผ่าตัดกระเพาะอาหารและลำไส้เล็กส่วนต้นทะลุ

วิธีการศึกษา: ผู้ป่วยหลังได้รับการผ่าตัดกระเพาะอาหารและลำไส้เล็กส่วนต้นทะลุทั้งหมด 110 รายแบ่งเป็นกลุ่มที่เริ่มให้อาหารทางปากเร็วภายในระยะเวลาไม่เกิน 72 ชั่วโมงหลังผ่าตัด (กลุ่ม ENS) กับกลุ่มที่เริ่มให้อาหารทางปากแบบดั้งเดิม (หลัง 72 ชั่วโมง) (กลุ่ม TPC) โดยเปรียบเทียบอัตราการเกิดภาวะแทรกซ้อนภายใน 30 วัน หลังการผ่าตัด อัตราการเกิดภาวะแทรกซ้อนที่สัมพันธ์กับการติดเชื้อภายใน 30 วันหลังผ่าตัด อุบัติการณ์ของภาวะรอยต่อลำไส้รั่ว อาการอึดแน่นท้องและอาเจียนหลังเริ่มให้อาหารทางปากและเวลาที่ได้เริ่มอาหารทางปากในกลุ่มที่เริ่มให้อาหารทางปากเร็วระยะเวลาการนอนโรงพยาบาล

ผลการศึกษา: พบภาวะแทรกซ้อนภายใน 30 วันหลังการผ่าตัดกระเพาะอาหารและลำไส้เล็กส่วนต้นทะลุ ทั้งหมด 5 ราย (ร้อยละ 4.54) โดยกลุ่ม TPC มีโอกาสเกิดภาวะแทรกซ้อนภายใน 30 วัน หลังผ่าตัดมากกว่ากลุ่ม ENS 1.5 เท่า (ร้อยละ 5.5; ร้อยละ 3.6, $P < 0.999$) พบว่าการติดเชื้อแผลผ่าตัดชั้นต้น เป็นภาวะแทรกซ้อนที่สัมพันธ์กับการติดเชื้อภายใน 30 วันหลังการผ่าตัดที่พบมากที่สุด โดยกลุ่ม TPC มีโอกาสเกิดการติดเชื้อแผลผ่าตัดชั้นต้นมากกว่า กลุ่ม ENS 1.5 เท่า (ร้อยละ 5.5 ; ร้อยละ 3.6 , $P > 0.999$) และไม่พบรอยรั่วของรอยต่อลำไส้ในผู้ป่วยทั้งสองกลุ่ม ทั้งนี้ พบว่ามีผู้ป่วย 1 รายที่อยู่ในกลุ่ม TPC มีอาการอึดแน่นท้องและอาเจียนหลังเริ่มให้อาหารทางปาก แต่เริ่มรับประทานอาหารดีขึ้น หลังการรักษาโดยการประคับประคอง นอกจากนี้พบว่าระยะเวลา 40 ชั่วโมงหลังผ่าตัดเป็นระยะเวลาที่ผู้ป่วยในกลุ่ม ENS สามารถเริ่มให้อาหารทางปากได้ และระยะเวลาการนอนโรงพยาบาล ในกลุ่ม TPC และกลุ่ม ENS คือ 7 วัน

สรุปผลการศึกษา: การเริ่มให้อาหารทางปากเร็วในกลุ่มผู้ป่วยที่ได้รับการผ่าตัดกระเพาะอาหารและลำไส้เล็กส่วนต้นทะลุ พบว่ามีแนวโน้มที่จะสามารถลดภาวะแทรกซ้อนภายใน 30 วัน และภาวะแทรกซ้อนที่สัมพันธ์กับการติดเชื้อภายใน 30 วัน และภาวะแทรกซ้อนที่สัมพันธ์กับการติดเชื้อภายใน 30 วันหลังการผ่าตัดลงได้ โดยไม่พบว่าเพิ่มภาวะรอยต่อลำไส้รั่วและอาการอึดแน่นท้องและอาเจียนหลังเริ่มอาหารทางปาก เมื่อเทียบกับการเริ่มให้อาหารทางปากแบบดั้งเดิม

Hand-Made Silk Loop Versus Hem-O-Lok Clip in Single Port Laparoscopic Appendectomy: A Randomized Controlled Trial

Manasawin Imsanguanchai, MD

Chusaeng Teerawiwatchai, MD

Department of General Surgery, Hatyai Hospital, Hatyai, Songkhla, 90110, Thailand

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Abstract

Background: Instruments used for closing the appendicular stump contribute to the high cost of laparoscopic appendectomy. In the present study a hand-made Roeder loop made of 3-0 silk to be placed on the appendicular stump and tightened by a plastic tube was created to reduce operative costs.

Objective: The objective of the present study was to compare the operative time in single port laparoscopic appendectomy, when using hand-made silk loop and when using hem-o-lok clip, a commercial instrument, in the closure of the appendicular stump in patients diagnosed with acute appendicitis.

Methods: Patients who were diagnosed as having uncomplicated acute appendicitis at Hatyai Hospital in Songkhla, Thailand were enrolled from January 2018 to September 2019. The primary outcome was operative time. Patients were randomized to either the hand-made silk loop group or the hem-o-lok clip group. Data collected included age, gender, body mass index, operative time, pathological report, operative cost, pain score at 4, 8, 12, and 24 hours after operation, hospital stay, and 30-day postoperative complications.

Results: Thirty-eight patients were included in the study. There were no significant differences between the two groups in terms of age, gender, body mass index, and American Society of Anesthesiologists classification. The mean operative time \pm SD was 41.4 ± 14.8 minutes in the hand-made silk loop group and 50.2 ± 19.8 minutes in the hem-o-lok clip group, which were not significantly different ($p = 0.14$). The cost of 3 hand-made silk loops used for each operation was 17 baht, and for the 3 hem-o-lok clips was 795 baht. The pain score at 4, 8, 12, and 24 hours, and hospital stay, were similar in both groups. No 30-day postoperative complication was observed in both groups.

Conclusion: The use of hand-made silk loop to close the appendicular stump in single port laparoscopic appendectomy resulted in a similar operative time as that with the use of hem-o-lok clip. Hand-made silk loop is safe, simple and effective for the closure of appendicular stump, and may help reduce operative cost.

Keywords: Acute appendicitis, Appendicular stump, Hand-made silk loop, Hem-o-lok, Single port laparoscopic appendectomy

Correspondence address: Chusaeng Teerawiwatchai, MD, Department of General Surgery, Hatyai Hospital, Hatyai, Songkhla, Thailand, 182 Ratakarn Rd., Hatyai, Songkhla 90110, Thailand; Tel: +66 7423 1032 ext. 3410; Email: chusaeng2002@yahoo.com, schusaeng@gmail.com

INTRODUCTION

Acute appendicitis is one of the most common abdominal emergencies. In 1983, Semm introduced three-port laparoscopic appendectomy for the treatment of acute appendicitis¹. Since then, laparoscopic appendectomy has been accepted as a standard for the treatment of acute appendicitis. Its advantages include less postoperative pain, faster postoperative recovery, shorter hospital stay, and fewer postoperative complications, when compared with open appendectomy^{4,12}. Single port laparoscopic appendectomy (SPLA) was introduced in 1998³. Recent meta-analyses have shown similar postoperative morbidity and wound infection rates for SPLA as for conventional laparoscopic appendectomy^{15,16,19}.

Techniques for appendicular stump closure include the use of staples, commercial endoloops (e.g., Endoloop^(R) Ligature Ethicon Endo-surgery, Johnson & Johnson, Cincinnati, OH, USA), titanium clips, non-absorbable polymer clips (hem-o-lock^(R) Surgical Instruments, Teleflex Medical, Durham, NC, USA), extracorporeal sliding knot, and intracorporeal ligature²⁰. The staple technique results in the safest closure, even when the appendiceal base is inflamed or considerably enlarged, but it is also the most expensive¹¹. Endoloop is safe for closing the appendix stump, and its cost is lower as compared to staplers¹⁰. Hem-o-lok clips appear to be superior to the endoloop in terms of shorter operative time, while maintaining comparable safety.

The hand-made Roeder silk endoloop in the present study was made of 3-0 silk, and autoclaved before use. The knot of the loop can be placed on the appendicular stump and tightened by a plastic tube (Figure 1). The silk loop was made solely with the aim to reduce operative costs. The hem-o-lok clip (Weck Closure Systems, Research Triangle Park, NC, USA) used in the present study is a V-shaped clip made of nonabsorbable material in XL size. During application, two loops or clips are



Figure 1 Hand-made silk endoloop instrument

placed at least 3 to 4 mm apart (Figures 2 to 3).

In the present study, we performed a randomized controlled study of SPLA for uncomplicated appendicitis, to compare the total operative time when using the hand-made silk endoloop, with that when using the hem-o-lok clips, for the closure of appendicular stump. The hope is that, with comparable ease of use and safety, the hand-made silk loop stump closure may be a viable, cheaper option in laparoscopic appendectomy.

PATIENTS AND METHODS

The study was conducted at Hatyai Hospital in Songkhla, Thailand, and was registered on clinicaltrials.in.th, with number TCTR 21080718004, and approved by the Research Ethics Committee of Hatyai Hospital (REC-HY, No10/2561), Songkhla. The sample size was estimated to be at least 20 patients per group, based on a similar study by Delibegovic⁷. Forty-eight patients with a diagnosis of acute appendicitis were enrolled into the present study from January 2018 to September 2019. Written informed consent was obtained from all patients before randomization.

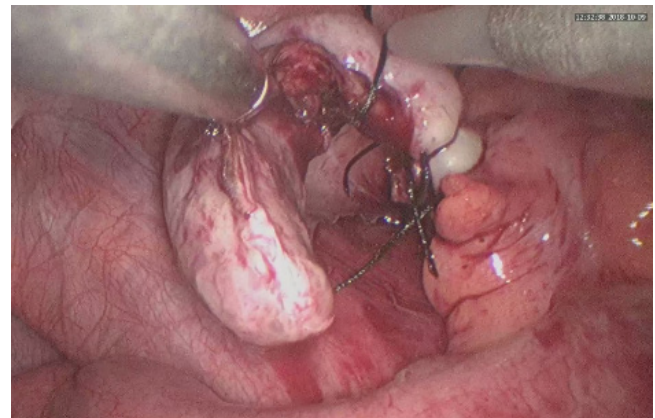


Figure 2 Hand-made silk endoloop ligation technique

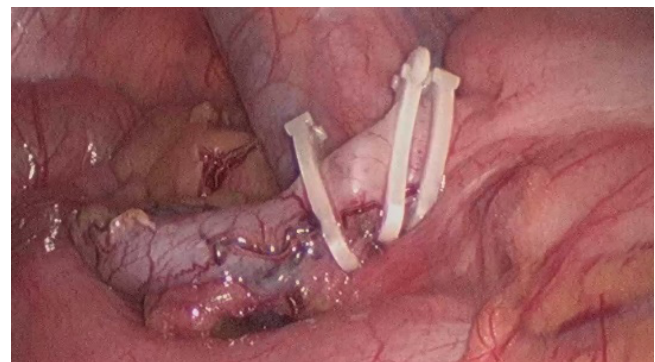


Figure 3 Hem-o-lok clip technique

Exclusion criteria included: age less than 14 years, pregnancy, presence of perforated appendicitis or appendiceal mass, classified as the American Society of Anesthesiologists class 4 or 5, and contraindications to general anesthesia. Patients undergoing laparoscopic appendectomy (available only from 8.30 a.m. to 16.30 p.m. at our institution) were randomly allocated via computer-generated randomization to the hand-made silk loop group (SL) or the hem-o-lok group (HL).

All patients in the study received 500 milligrams of metronidazole and 2 grams of ceftriaxone 2 grams intravenously within 30 minutes before incision. All patients were instructed to void urine prior to anesthesia, so no urinary catheters were used.

After induction of general anesthesia, a skin incision of length 1.5 to 2.0 cm was made at the umbilicus by a surgeon who had performed over 200 laparoscopic appendectomies. The glove port (Nelis, Gyeonggi-do, Korea) was introduced through the umbilical incision. The patient was placed in the Trendelenburg position with the right side rotated up. Pneumoperitoneum was established with CO₂ insufflation, and the intra-abdominal pressure was kept below 15 mmHg. A rigid zero degree 10-mm laparoscope was used to visualize the intra-abdomen. We used two 5 mm laparoscopic graspers to mobilize the appendix. A laparoscopic bipolar electrothermal instrument (LigaSure™ 5mm blunt tip, Covidien, Mansfield, Massachusetts, USA) was used to divide the mesoappendix.

In the SL group, two proximal and one distal hand-made silk loops were applied to close the stump of the appendix (Figure 2). In the HL group, the appendiceal stump was closed with two proximal and one distal XL-size hem-o-lok clips (Figure 3). The appendix was transected with LigaSure™ between proximal and distal loops or clips, in both groups. After checking for bleeding and contamination, the transected appendix was removed together with the glove port to reduce contamination of the abdominal wall. The fascia was closed with interrupted 1-0 absorbable sutures. The skin was closed with 4-0 absorbable, subcuticular sutures.

Patients were seen in the out-patients clinic at the first week and 30 days after operation. They were evaluated by the same surgeon for any signs of complications. Data collected included age, gender, body mass index (BMI), operative time, pathological report, operative cost, pain score at 4, 8, 12, and 24 hours after surgery (scored from 1 to 10), length of hospital stay, and 30-day

postoperative complications. The latter included wound infection, wound abscess, intra-abdominal abscess, lung atelectasis, re-operation for any reason, postoperative adhesion or postoperative bleeding. Operative time was defined as the duration in minutes between skin incision to skin closure.

Statistical analysis was performed using Stata version 13 (Stata Corp LLC, Texas, USA). Two groups were compared using Student's t-test for continuous variables. Categorical variables were compared using Chi-square test or Fisher's exact test. Numerical data were presented as mean \pm S.D. and categorical data were expressed as counts and proportion (in percent). Statistical significance was defined as a *p*-value \leq 0.05.

RESULTS

Forty-eight patients diagnosed with acute appendicitis were included in the present study. Ten patients were excluded, due to the presence of ruptured appendicitis in 6, and misdiagnosis in 4 (neuroendocrine tumor, corpus luteal cyst, ruptured gallbladder and cecal mass). There were 18 patients in the SL group, and 20 patients in the HL group. The final, pathological, diagnosis in all patients was acute appendicitis.

Of the 38 patients, 28 (74%) were men and 10 (26%) were women. The mean age (S.D.) was 36.2 (14.4) years in the SL group and 34.5 (16.4) years in the HL group. There were no differences in age, gender, BMI and ASA class between the 2 groups (Table 1). No conversion from laparoscopic to open technique occurred, and neither additional ports nor intra-abdominal drains were required. The mean operative time was shorter in SL group (41.4 \pm 14.3 minutes) than in the HL group (50.2 \pm 19.8 minutes) but not significantly so. The pain score at 4, 8, 12, and 24 hours after surgery and the length of hospital stay were similar in both groups. No 30-day postoperative complication was observed in both groups (Table 2). There was no leakage of the appendiceal stump and no ligature or clip dislodgement in both groups. The cost of 3 hand-made silk endoloops was 17 baht, while the 3 hem-o-lok clips cost 795 baht in Thailand.

DISCUSSION

Laparoscopic appendectomy has several advantages over open appendectomy. This includes more complete examination of the abdominal cavity, less pain, shorter hospital stay, more rapid recovery, fewer complications and better wound cosmesis^{4,12}.

Table 1 Characteristics of patients in the study

Characteristics	SL (n=18)	HL (n=20)	p-value
Age, years: mean ± SD	36.1±14.4	34.5±16.4	0.69
Male/Female: number	14/4	14/6	0.59
BMI, kg/m ² : mean ± SD	24.3±4.2	23.8±5.6	0.72
ASA class I: number	1	2	0.62
ASA class II: number	16	16	0.46
ASA class III: number	1	2	0.62

SL=hand-made silk endoloop; HL=hem-o-lok clip; BMI=body mass index; ASA class=American Society of Anesthesiologists classification

Table 2 Postoperative outcomes (mean ± SD)

Outcomes	SL (n=18)	HL (n=20)	p-value
Operative time, minutes	41.4 ± 14.3	50.2 ± 19.8	0.14
Pain at 4 hours	5.4 ± 3.3	4.2 ± 3.0	0.22
Pain at 8 hours	4.2 ± 3.0	4.0 ± 2.6	0.81
Pain at 12 hours	2.4 ± 2.4	2.5 ± 2.4	0.94
Pain at 24 hours	3.0 ± 2.6	2.2 ± 2.1	0.27
Hospital stay, hours	78.3 ± 38.9	81.2 ± 41.2	0.82

SL=hand-made silk endoloop; HL=hem-o-lok clip; Pain is scored on a numeric scale from 1 to 10

Disadvantages include longer operating time, higher cost, and the need for laparoscopic experience. With advances in laparoscopic technique and equipment, the SPLA procedure was introduced, which further decreases incision length, reduces postoperative pain, with even more rapid recovery and smaller scar^{15,16,19}.

One important component of the cost of laparoscopic appendectomy is the laparoscopic equipment and technique of securing the appendiceal stump. Closure of the appendicular stump is an important step in laparoscopic appendectomy because, if not done properly, serious complications from stump leakage including fecal fistula, intra-abdominal abscess and sepsis may occur.

Stapling is the safest method to close the appendiceal stump but it is also the most expensive^{2,6,7}. Advantages of staplers include ease of use, shorter learning curve, shorter operative time, and is safe even when the appendiceal base is inflamed or is rather large. Staples can also prevent mucosa protrusion, spillage of fecal material or pus, and with complete closure of the appendiceal stump, should result in a lower risk of intra-abdominal abscess or collection¹¹.

The endoloop is also safe for closing the appen-

diceal stump, and is much cheaper, but requires longer operative time as compared to staplers^{8,14,17}. A few studies seem to show higher risks of surgical-site infection and unplanned readmission when using the endoloop, compared with using staples⁹. This may be due to the presence of the exposed appendiceal mucosa, some spillage of fecal material during the division of the appendix, or fecal dislodgement from the appendiceal stump. Also, the endoloop may not be safe for the closure of inflamed appendiceal stump, and if the endoloop is tied too tightly, stump breakdown from suture cut-through with leakage may occur. The endoloop technique requires dexterity, and some experience in tying different appendiceal stump sizes before a surgeon can use the technique safely.

The advantages of the hem-o-lok clips include simplicity of application, shorter operative time, and its relative cheapness^{7,11,13,21}. One disadvantage is the failure to safely secure bulging or severely inflamed appendicular base (e.g., when diameter size is more than 1 cm). The locking mechanism of a hem-o-lok clip is key to safely secure the stump, and the clip must fit tightly around the appendiceal stump prior to closure of the locking mechanism, as slipping off the stump may

result in stump leakage. XL-size hem-o-lok also requires size 12-mm trocar to employ, and even then, it cannot secure large, inflamed appendices.

In our study, the operative time of SPLA when using hand-made silk endoloop was shorter even than that when using hem-o-lok clip, but this difference was not significant. The shorter operative time may reflect the extensive experience of the surgeon in using the endoloop. The postoperative pain scores, the lengths of hospital stay were not significantly different between the 2 groups. No 30-day postoperative complications were seen in both groups. This was similar to our previous study²², in which SPLA using hand-made silk loops was compared to open appendectomy, and only 2 patients in the SPLA group had superficial surgical site infection but no intra-abdominal abscesses. Controlled contamination during the division and securing the appendiceal stump is an important step to prevent intra-abdominal infection.

The endoloop technique can be used for appendiceal stump of all sizes but requires experience. A limitation of hem-o-lok clip is a higher risk failure if applied to severely inflamed or enlarged appendicular stump, but these were excluded from the present study. The cost of 3 hand-made silk endoloops was 17 baht, and in comparison, 3 hem-o-lok clips cost 795 baht in Thailand. Therefore, the cost of laparoscopic appendectomy can be reduced by more than 778 baht per case if hand-made silk loops were used instead of the hem-o-lok clips. In the present study, as in some other studies, hand-made silk loop is a safe and cheaper method for closure of the appendicular stump^{6,14,21-22}.

CONCLUSION

The use of hand-made silk endoloop to close the appendicular stump in single port laparoscopic appendectomy resulted in a similar operative time as that with the use of hem-o-lok clip. Hand-made silk loop is safe, simple and effective for the closure of appendicular stump, and may help reduce operative costs.

FUNDING SOURCES AND CONFLICTS OF INTERESTS

No competing financial interests exist.

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WHAT IS ALREADY KNOWN ON THIS TOPIC?

There are many studies comparing appendicular stump closure techniques in laparoscopic appendectomy. Some studies appeared to show hem-o-lok clips to be superior to endoloops in terms of shorter operative time and cost, while being similarly safe.

WHAT THIS STUDY ADDS?

This study shows that hand-made silk endoloop is cheaper than hem-o-lok clip when used to secure appendicular stumps in single port laparoscopic appendectomy, with similar outcomes.

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บทคัดย่อ การศึกษาสุ่มเปรียบเทียบการใช้ลูปไหมประดิษฐ์ขึ้นเองเทียบกับอุปกรณ์ Hem-o-lok ในการผ่าตัดไส้ติ่งผ่านกล้องส่องช่องท้องเดียว

มนัสวิน อิมสงวนชัย, พ.บ., ชูแสง ชีระวิวัฒน์ชัย, พ.บ.

กลุ่มงานศัลยกรรม โรงพยาบาลหาดใหญ่ จังหวัดสงขลา

ความเป็นมา: การผ่าตัดไส้ติ่งเป็นการผ่าตัดที่พบบ่อยและการผ่าตัดแบบส่องกล้องช่วยลดความเจ็บปวดแต่ยังมีคำรุกรายแพ่ง. อุปกรณ์ที่ใช้ในการผ่าตัดปิดต่อไส้ติ่งเป็นปัจจัยหนึ่งที่ทำให้ค่าผ่าตัดสูงขึ้น อุปกรณ์ hand-made silk endoloop เป็นการดัดแปลงอุปกรณ์ที่มีอยู่มาใช้เพื่อลดค่าใช้จ่ายและเวลาในการผ่าตัด การศึกษานี้ต้องการเปรียบเทียบระยะเวลาที่ใช้ในการผ่าตัดในการผ่าตัดผู้ป่วยที่ได้รับการวินิจฉัยว่าเป็นไส้ติ่งอักเสบเฉียบพลันโดยการใช้ hand-made silk endoloop กับ hemolock เพื่อปิดต่อของไส้ติ่งในการผ่าตัดไส้ติ่งแบบส่องกล้องรูเดียว

วิธีการศึกษา: ผู้ป่วย 48 รายที่ได้รับการวินิจฉัยว่าเป็นไส้ติ่งอักเสบเฉียบพลันในโรงพยาบาลหาดใหญ่ จังหวัดสงขลา ประเทศไทยเข้าร่วมการวิจัยตั้งแต่เดือนมกราคม 2561 ถึงเดือนกันยายน 2562 จุดประสงค์หลักของการศึกษาเพื่อเปรียบเทียบระยะเวลาที่ใช้ในการผ่าตัดไส้ติ่งอักเสบเฉียบพลันโดยการใช้ hand-made silk endoloop กับ hemolock เพื่อปิดต่อของไส้ติ่งในการผ่าตัดไส้ติ่งแบบส่องกล้องรูเดียว ผู้ป่วย 6 รายที่ได้รับการวินิจฉัยว่าไส้ติ่งอักเสบแตกทะลุและ 4 รายที่ได้รับการวินิจฉัยว่าเป็นโรคอื่น (neuroendocrine tumor, corpus luteal cyst, ruptured gallbladder and cecal mass) ได้ถูกคัดออกจากการศึกษา ผู้ป่วยทั้งหมดได้รับการสุ่มโดยการใช้คอมพิวเตอร์เข้ากลุ่ม hand-made silk endoloop หรือ hem-o-lock ข้อมูลที่ถูกเก็บ อายุ ดัชนีมวลกาย ระยะเวลาที่ใช้ในการผ่าตัด การรายงานผลขึ้นเนื้อ ราคาอุปกรณ์ ระดับความปวดแบบตัวเลข ระยะเวลาที่อยู่ในโรงพยาบาล ภาวะแทรกซ้อนที่เกิดขึ้นหลังผ่าตัดภายใน 30 วัน

ผลการศึกษา: ผู้ป่วย 38 ราย ได้เข้าร่วมการศึกษา ไม่มีความแตกต่างอย่างมีนัยสำคัญ ในเรื่องอายุ เพศ ดัชนีมวลกายและ ค่า ASA ระหว่าง 2 กลุ่ม ระยะเวลาเฉลี่ยที่ใช้ในการผ่าตัดของทั้ง 2 กลุ่ม ไม่มีความแตกต่างกัน ระยะเวลาที่ใช้ในการผ่าตัด 41.4 ± 14.8 นาที ในกลุ่ม SL ระยะเวลาที่ใช้ในการผ่าตัด 50.2 ± 19.8 นาที ในกลุ่ม HL ราคาอุปกรณ์ hand-made silk loops 3 ชิ้น เท่ากับ 17 บาท ราคาอุปกรณ์ hem-o-lok clips 3 ชิ้น เท่ากับ 795 บาท ระดับความปวดหลังผ่าตัดที่ 4, 8, 12, 24 ชั่วโมงหลังผ่าตัด ระยะเวลาที่นอนโรงพยาบาลหลังผ่าตัดและภาวะแทรกซ้อนหลังผ่าตัด 30 วัน

สรุปการศึกษา: ระยะเวลาเฉลี่ยที่ใช้ในการผ่าตัดเฉลี่ยในกลุ่มที่ใช้ hand-made silk Endoloop และ hemolock เพื่อปิดต่อไส้ติ่งผู้ป่วยไส้ติ่งอักเสบที่ผ่าตัดโดยการส่องกล้องแบบรูเดียวไม่มีความแตกต่างอย่างมีนัยสำคัญ สำหรับการศึกษานี้ hand-made silk Endoloop สามารถใช้ในการผ่าตัดส่องกล้องแบบรูเดียวได้ปลอดภัยด้วยราคาที่ต่ำกว่ามาก

Comparison of Outcomes and Cosmetic Satisfaction of Bilateral Trans-Axillary Endoscopic Total Thyroidectomy versus Conventional Open Total Thyroidectomy

Putthiporn Yenbutra, MD^{*,†}

Todsaporn Liangyu, MD^{*}

Suchart Chantawibul, MD^{*,†}

^{*}Department of Surgery, Rajavithi Hospital, Department of Medical Services, Ministry of Public Health of Thailand, Bangkok, Thailand.

[†] Department of Surgery, College of Medicine, Rangsit University, Bangkok, Thailand

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Abstract

Objective: The purpose of the present study was to compare the outcomes and cosmetic satisfaction achieved by bilateral trans-axillary endoscopic total thyroidectomy to those of conventional open total thyroidectomy at Rajavithi Hospital.

Methods: A retrospective study was conducted on 11 patients who underwent bilateral trans-axillary endoscopic thyroidectomy and 20 patients who had conventional total thyroidectomy between April 2013 and April 2018. Bilateral trans-axillary endoscopic thyroidectomy was performed using a four-port technique, and ultrasonic devices were used for dissection. Demographic data, weight of thyroid gland, mean operative time, blood loss, hospital stay, complications and scar satisfaction in the two groups were compared.

Results: Bilateral trans-axillary endoscopic total thyroidectomy was successfully performed in all cases without conversion to the open technique. Operative time for the endoscopic group was longer than for that for open total thyroidectomy (293 ± 58 vs 165 ± 52 minutes, $p < 0.001$); however, operative blood loss (124 ± 18 vs. 231 ± 19 mL, $p = 0.134$) and duration of hospital stay (6.5 ± 1.7 vs. 6.9 ± 1.9 days, $p = 0.582$) were lower for the endoscopic technique, even though these findings were not statistically significant. Scar satisfaction in all parameters, such as wound color, size and overall satisfaction were better in the endoscopic group, $p = 0.001$. With the open technique, transient recurrent laryngeal nerve injury was found in 1 patient (5%) and transient hypocalcemia occurred in 4 cases (25%). There were no serious complications in the bilateral trans-axillary endoscopic total thyroidectomy group.

Conclusion: Bilateral trans-axillary endoscopic thyroidectomy is an appropriate option for total thyroidectomy; however, the surgeon should be familiar with laparoscopic operations, and suitable cases should be selected for this procedure.

Keywords: Bilateral trans-axillary endoscopic thyroidectomy, Total thyroidectomy, Outcome, Cosmetic satisfaction

Correspondence address: Putthiporn Yenbutra, MD, Department of Surgery, Rajavithi Hospital, 2, Phayathai Road, Thung Phayathai, Ratchthewi, Bangkok, Thailand 10400; Tel.: 0 2206 2902, Fax: 0 2354 8080; E-mail: putsurg@windowslive.com

INTRODUCTION

Thyroid nodules are more common in women^{1,2}, many of whom worry about the cosmetic outcome of surgery, specifically the neck scar. Even though conventional open total thyroidectomy (COT) can remove the entire thyroid gland, this procedure may leave a permanent surgical neck scar that can become hypertrophic. Currently there are various remote-access^{3,4} thyroidectomy procedures that bring the surgical wound to another area away from the neck, and trans-axillary endoscopic thyroidectomy is one of these options. This procedure has an advantage over COT in that it does not involve neck incisions and enables easy identification of recurrent laryngeal nerves and parathyroid tissue because the operative field is magnified by a laparoscope. However, surgeons who perform this procedure need to be familiar with laparoscopic techniques and have experience with open thyroidectomy. We hypothesized that bilateral trans-axillary endoscopic total thyroidectomy would have comparable surgical outcomes to those of COT but is superior cosmetically. Only a few studies have compared bilateral trans-axillary endoscopic total thyroidectomy with COT; most studies have focused on comparing these two techniques in thyroid lobectomy^{5,6}.

MATERIALS AND METHODS

The present study was approved by the Institutional Review Board of Rajavithi Hospital, Bangkok, Thailand (143/2558). A retrospective and cross-sectional medical record review was conducted on 31 patients who underwent total thyroidectomy between April 2013 and April 2018 at the Department of Surgery, Rajavithi Hospital. Patients found to have thyroid nodules underwent fine needle aspiration (FNA) in accordance with the American Thyroid Association management guidelines for adult patients with thyroid nodules and differentiated thyroid cancer⁷. FNA results were then classified in accordance with the Bethesda System⁸. The indications for total thyroidectomy included compressive symptom, hyperthyroidism uncontrolled by medication, and thyroid cancer without lymph node metastasis. For bilateral trans-axillary endoscopic thyroidectomy, the maximum thyroid nodule size was 6 cm. Exclusion criteria included previous neck surgery or thyroid cancer with lymph nodes metastasis, and follow-up time of less than 2 years after surgery. Patients' age, BMI, gender, thyroid volume and definite pathologic results after surgery were recorded.

Eleven patients underwent bilateral trans-axillary endoscopic thyroidectomy and 20 underwent COT. Operative time, blood loss and hospital stay were recorded. Serum calcium levels were measured on postoperative days 1 and 2, and postoperative hypoparathyroidism was diagnosed when corrected total calcium was less than 8 mg/dL. Patients who had hypocalcemia were given supplementary calcium carbonate, 2 to 3 g/day. Permanent hypocalcemia was defined as low serum calcium persisting for more than 6 months. Post-operative vocal cord assessment was performed in patients with suspected recurrent laryngeal nerve injury, such as those with hoarseness or stridor. Recurrent laryngeal nerve injury was defined as permanent when there was persistent impairment for more than 1 year; otherwise, it was considered transient.

All patients were followed at 2 weeks, 1 month, 3 months, 6 months and 1 year after thyroidectomy. Physical examination of the wound and voice assessment were performed. In cases of suspected recurrent laryngeal nerve injury, vocal cords were assessed by an ENT specialist. Laboratory tests for thyroid function and calcium level were also evaluated.

At 1-year follow-up, surgical scar satisfaction was assessed using 4 parameters: overall satisfaction, satisfaction with color, satisfaction with size and satisfaction with symmetry of the scar. These satisfaction parameters were graded on a 5-point Likert scale (5 points for extremely satisfied and 1 point for extremely dissatisfied).

Numerical results were summarized as counts (percentage), median (range), or mean (standard deviation), as appropriate. Statistical comparison of data between two groups was performed by Student's t-test in the case of Normal-distributed data. For data that did not have a Normal distribution, Mann-Whitney U-test was used. Categorical data were compared using the chi-square test. A p-value of 0.05 or less was considered statistically significant. The IBM SPSS Statistics software version 22 was used for all analyses.

Operative Technique

Bilateral trans-axillary endoscopic thyroidectomy was performed with the patient set in the supine position with neck extension. Both arms were raised over the patient's head and fixed until the operation was finished. At Rajavithi Hospital, we have constructed a custom-made, special metallic instrument that can fix both arms of the patient in the appropriate position, and we used

this instrument in all cases.

We employed a 4-port technique inserted through the axillary area. A 3-cm incision was made at the axillary skin crease to create a subcutaneous tunnel above the pectoralis major muscle across the clavicle to the sternocleidomastoid. A 10 mm flexible or rigid laparoscope was inserted through this port, after which any residual skin gap was sutured to ensure air-tightness. Two 5-mm incisions were created at the right and left sides of the laparoscopic port to insert an ultrasonic dissecting device and a grasper. The final 5-mm incision was made at the lateral part of the laparoscope port to insert a suction device, which was used not only for clearing the operative field also for retracting the sternocleidomastoid muscle laterally in order to easily identify the thyroid gland.

CO2 insufflation pressure was set at 6 mmHg. The operation was begun when the anterior border of the sternocleidomastoid muscle on one side was dissected laterally to identify the strap muscle, which was then split at the lateral part to reach the thyroid gland. The superior and inferior poles of the thyroid gland on that side were dissected free using an ultrasonic device without suturing or ligation, and the gland was mobilized medially to identify and preserve the recurrent laryngeal nerve and parathyroid glands. After completion of the same procedure on the contralateral side, the entire thyroid gland was removed via the 10 mm laparoscope incision. Neither the split strap muscles nor the sternocleidomastoid muscle required suturing, and no drains were employed in any case.

Conventional open total thyroidectomy (COT) was performed in a familiar fashion. A 5 to 8cm transverse collar incision was made, a subplatysmal plane was cre-

ated up to the thyroid cartilage, and the strap muscles were separated at the midline to identify the thyroid gland. The superior thyroid vessels were ligated and divided within 1cm of the superior pole to preserve the external branch of the superior laryngeal nerve. The recurrent laryngeal nerves and parathyroid glands were identified and preserved before the inferior thyroid artery on either side was divided. Finally, the inferior poles were ligated and divided, and a vacuum drain was placed and later removed when the drainage volume was less than 30 mL per day.

RESULTS

Over the 5-year period from April 2013 to April 2018, 11 patients, including 9 women and 2 men with a mean age of 35.5 ± 11.2 years, underwent bilateral trans-axillary endoscopic total thyroidectomy. Pathologic results revealed 5 cases of adenomatous goiter, 3 of diffuse follicular hyperplasia, 2 of papillary thyroid carcinoma, and 1 of Hashimoto’s thyroiditis. The mean weight of the thyroid gland was 59 ± 19 gm, the mean operative time was 293 ± 58 min, and the mean blood loss was 125 ± 18 mL. The mean length of hospital stay was 6.5 ± 1.7 days, and no serious complications were encountered with this technique.

All 20 patients who underwent COT were women, and their mean age was 51.0 ± 10.7 years. Pathologic results revealed 18 cases of adenomatous goiter, 1 of papillary thyroid carcinoma, and 1 of Hashimoto’s thyroiditis. The mean weight of the thyroid gland was 245 ± 21 gm, the mean operative time was 165 ± 52 min, and mean blood loss was 231 ± 19 mL. the mean length of hospital stay was 6.9 ± 1.9 days.

Table 1 Baseline characteristics of patients (n = 31)

Variables	Bilateral endoscopic thyroidectomy (n=11)	Open thyroidectomy (n=20)	p-value
Age, year: mean ± SD	35.5 ± 11.2	51.0 ± 10.7	0.001
BMI: mean ± SD	25.0 ± 15.1	25.5 ± 5.0	0.891
Gender Female: Male	9:2	20:0	
Pathology			
Adenomatous goiter	5 (45.5)	18 (90.0)	0.032
Follicular hyperplasia/Graves’ disease	3 (27.3)	0 (0.0)	
Hashimoto’s thyroiditis	1 (9.2)	1 (5.0)	
Papillary carcinoma	2 (18.18)	1 (5.0)	
Weight of thyroid, gm: mean ± SD	59.0 ± 19.1	244.9 ± 21.2	< 0.001

Table 2 Perioperative and postoperative data (n = 31)

Variables	Bilateral endoscopic thyroidectomy (n=11)	Open thyroidectomy (n=20)	p-value
Operative time, min: mean ± SD	293 ± 58	165 ± 52	< 0.001
Blood loss, mL: mean ± SD	125 ± 18	231 ± 19	0.134
Length of hospital stay, days: mean ± SD	6.5 ± 1.7	6.9 ± 1.9	0.582

Table 3 Operative complications (n = 31)

Operative complications	Bilateral endoscopic thyroidectomy (n=11)	Open thyroidectomy (n=20)
Transient hypocalcemia: number (%)	0	4 (20)
Transient RLN injury: number (%)	0	1 (5)
Permanent RLN injury: number (%)	0	0
Hematoma: number (%)	0	0
Wound infection: number (%)	0	0

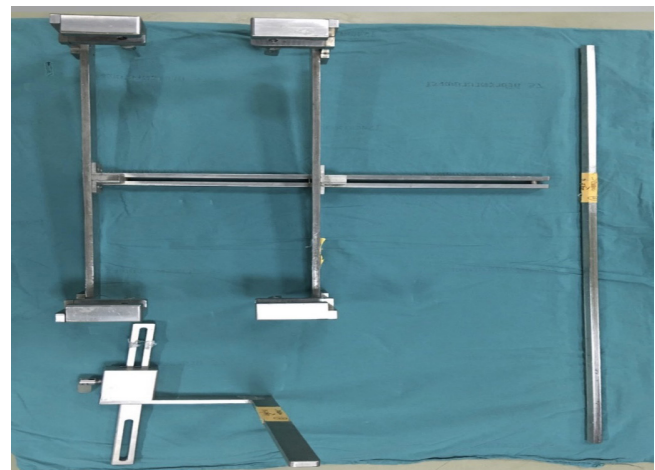
Table 4 Scar satisfaction (n = 31)

Satisfaction Score	Bilateral endoscopic thyroidectomy (n=11)	Open thyroidectomy (n=20)	p-value
Overall satisfaction: median (range)	5.0 (4 - 5)	3.5 (3 - 5)	0.001
Satisfaction-color: median (range)	5.0 (3 - 5)	4.0 (3 - 5)	0.027
Satisfaction-size: median (range)	5.0 (3 - 5)	4.0 (3 - 4)	0.001
Satisfaction-symmetry: median (range)	5.0 (4 - 5)	4.0 (3 - 4)	< 0.001

Four patients had transient hypocalcemia, and 1 had transient recurrent laryngeal nerve injury. Although there were more varied thyroid diseases in the bilateral trans-axillary endoscopic thyroidectomy group, this might not affect surgical and cosmetic outcomes.

Patients were significantly younger in the bilateral trans-axillary endoscopic thyroidectomy group ($p = 0.001$), and the weight of the thyroid gland in this group was also significantly lighter ($p < 0.001$). The mean operative time in this group was significantly longer ($p < 0.001$); however, blood loss and length of hospital stay were not significantly different.

Finally, we assessed scar satisfaction in the two groups at one year after surgery. In all parameters, including overall satisfaction ($p = 0.001$), color ($p =$

**Figure 1** Custom-made, metallic instrument for patient's positioning

0.027), size ($p = 0.001$) and symmetry ($p < 0.001$) of the scar, bilateral trans-axillary endoscopic thyroidectomy yielded superior results.

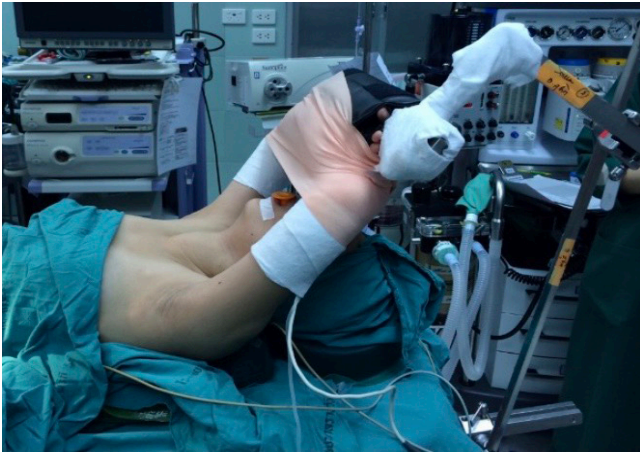


Figure 2 Patient's positioning for bilateral trans-axillary endoscopic thyroidectomy



Figure 3 Surgical scar of bilateral trans-axillary endoscopic thyroidectomy

DISCUSSION

Currently, there are many remote-access thyroidectomy techniques that bring the surgical scar to another area away from the neck to avoid conventional neck incisions^{3,4}. Trans-axillary thyroidectomy is one of

these techniques⁹. At present, there is little data on the results of comparing bilateral trans-axillary endoscopic total thyroidectomy to conventional transcervical total thyroidectomy^{5,6} because the former involves a longer operative time and a steep learning curve. Furthermore, positioning of the patient for the former technique can be problematic. At Rajavithi Hospital, to counter the latter difficulty, we have constructed a custom-made, metallic instrument that can fix both arms of the patient in the appropriate position in order to facilitate the performance of the trans-axillary technique. Further, we also split the strap muscle at the lateral part, so that the strap muscles do not require re-suturing in the midline. Finally, as we approach the thyroid gland from the lateral, and as the operative field is magnified by the laparoscope, the recurrent laryngeal nerves and parathyroid glands are easily identified and saved.

Bilateral trans-axillary endoscopic thyroidectomy required longer operative time than COT because a subcutaneous tunnel has to be created, together with a working space, to reach the thyroid gland bilaterally. However, operative blood loss seemed to be lower in the trans-axillary technique, possibly because of the smaller thyroid size and the use of ultrasonic devices in all cases to arrest bleeding. This finding is in keeping with those of other studies^{11,12}. The rates of complications were low in both groups, but bilateral trans-axillary endoscopic thyroidectomy seemed to have fewer complications than COT. Studies with larger sample sizes are required to corroborate this.

The most important reason for developing remote-access thyroidectomy is to improve cosmetic outcomes. In our study, we evaluated scar satisfaction in terms of 4 parameters: overall satisfaction, and satisfaction with color, size and symmetry of the scar. The results were as expected: bilateral trans-axillary endoscopic thyroidectomy was significantly better than COT in all cosmetic outcomes.

CONCLUSION

Bilateral trans-axillary endoscopic thyroidectomy is an attractive and safe procedure for total thyroidectomy, with good outcomes and superior cosmesis. However, surgeons who perform this procedure need to be familiar with laparoscopic techniques and also have some experience performing open thyroidectomy. Appropriate patient selection is also very important in order to achieve excellent results.

ACKNOWLEDGEMENTS

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WHAT THIS STUDY ADDS

1. Bilateral trans-axillary endoscopic thyroidectomy is a feasible procedure for treatment of surgical thyroid disease that requires total thyroidectomy, and it achieves excellent outcomes with very few complications.

2. In carrying out this procedure, the surgeon can set the operative position easily using our innovative instrument.

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บทคัดย่อ ศึกษาเปรียบเทียบผลการผ่าตัดและความพึงพอใจของบาดแผลระหว่างการทำผ่าตัดไทรอยด์ผ่านกล้องทางรักแร้ทั้งสองข้างกับการผ่าตัดไทรอยด์ออกทั้งต่อมบริเวณลำคอแบบดั้งเดิม

พุทธิพร เย็นบุตร*[†] ทศพร เลียงอยู่*, สุชาติ จันทวิบูลย์*[†]

* กลุ่มงานศัลยศาสตร์ โรงพยาบาลราชวิถี กรมการแพทย์ กระทรวงสาธารณสุข

[†] ภาควิชาศัลยศาสตร์ สถาบันร่วมผลิตแพทย์ กรมการแพทย์ – มหาวิทยาลัยรังสิต

ความเป็นมา: ถึงแม้การทำผ่าตัดไทรอยด์ทั้งสองข้างบริเวณลำคอจะเป็นการผ่าตัดมาตรฐาน แต่การผ่าตัดดังกล่าวทำให้เกิดบาดแผลบริเวณลำคอ ซึ่งไม่อาจคาดเดาได้ว่าจะเกิดแผลเป็นนูนหรือคีรอยด์หรือไม่ การผ่าตัดไทรอยด์ผ่านกล้องทางรักแร้จึงเป็นทางเลือกสำหรับผู้ป่วยเพื่อหลีกเลี่ยงบาดแผลบริเวณลำคอ

วัตถุประสงค์: เพื่อศึกษาเปรียบเทียบผลการผ่าตัดและความพึงพอใจของบาดแผลระหว่างการทำผ่าตัดไทรอยด์ผ่านกล้องทางรักแร้ทั้งสองข้างกับการผ่าตัดไทรอยด์ออกทั้งต่อมบริเวณลำคอแบบดั้งเดิม

วิธีการศึกษา: เป็นการเก็บข้อมูลผู้ป่วยทั้งหมดที่ได้รับการผ่าตัดต่อมไทรอยด์ผ่านกล้องทางรักแร้ทั้งสองข้างจำนวน 11 รายและการผ่าตัดต่อมไทรอยด์ออกทั้งต่อมบริเวณคอแบบดั้งเดิมจำนวน 20 ราย ตั้งแต่เดือนเมษายน 2013 ถึงเดือนเมษายน 2018 โดยการผ่าตัดไทรอยด์ผ่านกล้องนั้นใช้การลงแผลเฉพาะบริเวณรักแร้เท่านั้น (จำนวน 4 ports) และใช้อุปกรณ์ผ่าตัดด้วยเครื่องผ่าตัดความถี่สูง (ultrasonic device) ข้อมูลทั่วไปของผู้ป่วย ผลชิ้นเนื้อขนาดของต่อมไทรอยด์ ระยะเวลาในการผ่าตัด ปริมาณการเสียเลือด ระยะเวลาการนอนโรงพยาบาลและภาวะแทรกซ้อนจะได้รับการบันทึกเพื่อเปรียบเทียบ ส่วนความพึงพอใจของแผลผ่าตัดจะได้รับการสัมภาษณ์เปรียบเทียบหลังการผ่าตัด 1 ปี

ผลการศึกษา: แม้ว่าการผ่าตัดไทรอยด์ทางกล้องผ่านทางรักแร้ทั้งสองข้างจะใช้เวลามากกว่าการผ่าตัดไทรอยด์ออกทั้งต่อมแบบดั้งเดิมก็ตาม (293 ± 58 vs 165 ± 52 นาที, $p < 0.001$) แต่ไม่ว่าจะเป็นปริมาณการเสียเลือด (125 ± 18 vs 231 ± 19 , $p = 0.134$) หรือระยะเวลาการนอนโรงพยาบาล (6.5 ± 1.7 vs 6.85 ± 1.9 , $p = 0.582$) ไม่แตกต่างกัน ซึ่งผลดีของการผ่าตัดแบบนี้พบว่าความพึงพอใจของบาดแผลผ่าตัดในผู้ป่วยที่ได้รับการผ่าตัดผ่านกล้องดีกว่าอย่างมีนัยสำคัญทางสถิติ $p = 0.001$ นอกจากนี้ภาวะแทรกซ้อนของการผ่าตัดก็ค่อนข้างน้อย

สรุปผลการศึกษา: การผ่าตัดต่อมไทรอยด์ผ่านกล้องทางรักแร้ทั้งสองข้างในผู้ป่วยที่จำเป็นต้องตัดต่อมไทรอยด์ออกทั้งต่อมเป็นการผ่าตัดที่ปลอดภัยและสามารถใช้เป็นทางเลือกในผู้ป่วยที่มีความกังวลเรื่องแผลผ่าตัดบริเวณลำคอ แต่ควรเลือกผู้ป่วยให้เหมาะสม และศัลยแพทย์ควรมีทักษะการผ่าตัดทางกล้องเป็นอย่างดี

Abstracts of the 45th Annual Scientific Congress of The Royal College of Surgeons of Thailand, 8-11 October 2020, RCST Virtual Annual Congress 2020 (Part II)

Free Paper Neurosurgery

BRAIN MASS IN PATIENTS WITH CANCER HISTORY IN CHONBURI HOSPITAL

Prateep Kongnaewdee

Department of Surgery, Chonburi Hospital

Background: Most frequent brain tumor is metastatic tumor. Overall patients with brain metastases typically have a mean survival of one month without treatment. With treatment, the mean age of survival is still less than one year.

Objective: To evaluate many factors such as gender, age, time lag between diagnosis of systemic cancer and brain mass, type of systemic cancer and brain tumor resection whether they affect the survival time.

Materials and Methods: Retrospective study of 241 systemic cancer with brain mass patients who were admitted in Chonburi Hospital during 30 December 2012 - 30 April 2018. Analysis using independent t-test and Kaplan-Meier survival curve to evaluate factors that affect the survival time.

Results: There were 121 males and 120 females in this study. Most of them age between 40-79 years.

Lung cancer is the most frequent systemic cancer, found in 138 patients (57.26%). The others were ca breast, ca colon, unknown primary etc. Finding in CT or MRI brain revealed multiple brain masses in 124 patients (51.45%), single brain mass in 112 patients (46.47%) and leptomeningeal enhancement in 5 patients (2.07%). 211 patients died during admission; 30 patients had loss to follow up. Brain mass resection were done in 58 patients. The pathological diagnosis of cerebral metastases were 57 cases. One case was astrocytoma grade 2 with history of CA colon for 3 years. The median survival time in this study was 6 months. Analysis of survival time show no correlation with many factors such as gender, age, primary cancer site, time lag between diagnosis of systemic cancer and brain masses. The factors that correlate with survival time are brain mass resection and characteristic of brain mass. Brain mass resected group has longer survival time than non-operated group. Single brain mass group also has better outcome than multiple mass group.

Conclusion: Factors that affect the survival time of systemic cancer patients with brain mass are brain tumor characteristic and brain tumor resection.

Free Paper Pediatric Surgery

CLINICAL AND OUTCOME OF PEDIATRIC INTRAABDOMINAL LYMPHATIC MALFORMATION IN QUEEN SIRIKIT NATIONAL INSTITUTE OF CHILD HEALTH: PRELIMINARY REPORT

Nitipon Wiangkham MD, Suranetr Chivapraphanant MD, Achariya Tongsin MD

Department of Pediatric Surgery, Queen Sirikit National Institute of Child Health, Bangkok, Thailand

Background: Intraabdominal lymphatic malformation is a rare entity in pediatric population. The etiology is caused by lymphatic channel obstruction leading to abnormal communication of the lymphatic systems. There are mostly benign and complete excision is the treatment of choice. The lesions vary from the simple cyst to the complicated cyst that encasing the organs and difficult to remove.

Objective: The purpose of this study is to analyses the clinical and outcome of intraabdominal lymphatic malformation in children.

Materials and Methods: Retrospective study of intraabdominal lymphatic malformation patients who were treated at Queen Sirikit National Institute of Child Health during January 2012 to December 2019. The demographic data, clinical presentation, radiological findings, operative findings, histology, procedures and outcomes were collected.

Results: Twelve patients [male 5, (41.7%), female 7, (58.3%)] were diagnosed and operated at age 5 months to 11 years (median age 4 years). The most common clinical presentation is abdominal pain [7 cases, (58.3%)]. The duration of symptom varied from 1 day to 1 year (median 1 month). Three of seven that presented with abdominal pain had the symptom like acute appendicitis [2 cases, (16.7%)] and peritonitis due to ruptured cyst [1 case, (8.3%)]. The root of mesentery is the common site of the lesion [9 cases, (75%)] and the jejunum is more common than other parts (5 of 9 cases). The range in size of the lesion was 3 to 20 cm in diameters (median 9 cm). Ten patients underwent complete excision (83.3%) but 7 cases required bowel resection. After surgery, all patients survived without recurrence.

Conclusion: This disease should be considered as the cause of acute abdomen. The preoperative diagnosis and localization for these cysts are difficult. Complete excision was possible in almost all cases despite the size, bringing a favorable outcome.

Keywords: Omental cyst, Mesenteric cyst, Intraabdominal cystic lymphangioma, Intra-abdominal lymphatic malformation

COMPARISON OF SURGICAL SITE INFECTION AFTER STOMA REVERSAL BETWEEN PURSE-STRING APPROXIMATION VERSUS PRIMARY LINEAR CLOSURE IN CHILDREN

Chanathip Sayuen¹, Kanokrat Thaiwatcharamas¹, Rattiyaporn Phannua¹, Sinobol Chusilp¹, Patchareeporn Tanning¹, Suchat Areemit¹, Katawaetee Decharun², Paisarn Vejchapipat²

¹Department of Surgery, Faculty of Medicine, Khon Kaen University, Khon Kaen 40002, Thailand

²Department of Surgery, Faculty of Medicine, Chulalongkorn University, Bangkok 10330, Thailand

Background: Temporary stoma is a commonly procedure performed in children with emergency gastrointestinal problems. Surgical site infection (SSI) is one of the most common complication following stoma reversal, of which an incidence can be up to 40%. To reduce this complication, a purse-string approximation technique has been widely performed and recommended in adult stoma reversal. However, the optimal technique for stoma reversal in children is still debated.

Objectives: The goal of this study is to compare the SSI rate between purse-string approximation (PSA) and primary linear closure (PLC) for skin closure of stoma reversal in children.

Materials and Methods: The data of pediatric patients who underwent either PSA or PLC for elective surgery of stoma reversal between January 2016 and December 2019, at Srinagarind Hospital, Khon Kaen and Chulalongkorn Hospital, Bangkok were retrospectively reviewed. The surgical site infection was observed within 30 days after surgery.

Results: In total, 76 patients underwent stoma reversal in the aforementioned period. PSA was performed in 31 patients and PLC was performed in 45 patients. Patients in both groups did not differ regarding age, gender, comorbidity, preoperative hemoglobin and albumin, type of stoma, type of bowel preparation, ASA classification, operative time, volume of blood loss, and overall postoperative complications. Three patients in the PSA group developed a SSI compared to 14 patients in PLC group at 30 days after surgery (9.7 vs 31.1%, $p = 0.028$). The median time to SSI detection was 5 days after surgery in both groups ($p = 0.70$). No difference was noted in overall postoperative complication. Patients who developed SSI significantly had a longer length of hospital stay (16 vs 10 days, $p = 0.001$), but no difference was noted in the length of hospital stay between PSA with SSI and PLC with SSI patients (16 vs 15 days, $p = 0.53$). On univariate analysis, PSA was the only predictive factor of SSI (OR 0.24, 95% CI = 0.06 – 0.91, $p = 0.036$). In multivariate analysis, SSI were significantly lower in patients with PSA (OR 0.21, 95% CI = 0.05 – 0.86, $p = 0.029$).

Conclusion: Using purse-string approximation technique for skin closure of stoma reversal has significantly lower SSI rate compared to primary linear closure with no difference in length of hospital stay and postoperative care. However, further studies are required to identify the impact of PSA on stoma reversal as well as cosmetic outcome.

Keywords: Stoma reversal wound, Ostomy closure, Purse-string approximation, Primary linear closure, Surgical site infection

MANAGEMENT AND OUTCOMES OF GASTRO-INTESTINAL CONGENITAL ANOMALIES IN LOW-, MIDDLE-, AND HIGH-INCOME COUNTRIES: A MULTI-CENTRE, INTERNATIONAL, PROSPECTIVE COHORT STUDY

Ampaipan Boonthai¹, Adesoji O Ademuyiwa², Emmanuel Ameh³, Justine Davies⁴, Kokila Lakhoo⁵, Dan Poenaru⁶, Niyi Ade-Ajayi⁷, Nick Sevdalis⁸, Andrew Leather⁹, Naomi Wright⁹, Global PaedSurg Research Collaboration¹⁰

¹ Department of Surgery, Ramathibodi Hospital, Bangkok, Thailand

² Paediatric Surgery Unit, College of Medicine, University of Lagos and Lagos University Teaching Hospital, Lagos, Nigeria

³ Paediatric Surgery Department, National Hospital, Abuja, Nigeria

⁴ Institute of Applied Health Research, University of Birmingham, Birmingham, UK

⁵ University of Oxford, Oxford, UK

⁶ McGill University, Montreal, Canada

⁷ Paediatric Surgery Department, King's College Hospital, London, UK

⁸ Centre for Implementation Science, King's College London, UK

⁹ King's Centre for Global Health and Health Partnerships, School for Population Health and Environmental Science, King's College London, UK

¹⁰ Participating institutions from across the globe

Background: Congenital anomalies (CAs) are the 5th leading cause of death in children under 5 years, globally. Without emergency surgical care, many gastrointestinal CAs are incompatible with life.

Objective: We compared, for the first time, management and outcomes of a selection of common gastrointestinal CAs in low-, middle- and high-income countries (LICs, MICs and HICs) globally.

Materials and Methods: Children's surgical care providers across the globe were invited to participate in the study and collect clinical data prospectively on consecutive patients presenting primarily with seven CAs (Table 1) over a minimum of one month between October 2018 - April 2019. The primary outcome was all-cause in-hospital mortality. Univariate analysis was used to identify factors associated with mortality ($p \leq 0.01$), which were then analysed using multivariate logistic regression, presented as (adjusted odds ratio, p value). All participating centers had study approval.

Results: 1,445 collaborators from 272 hospitals (11 LICs, 171 MICs, 90 HICs) in 74 countries contributed data. 3,841 patients with 3,967 study conditions were included. The following were associated with mortality: country income status (0.35, $p < 0.001$, Table 1), induced vaginal versus spontaneous delivery (0.42, $p = 0.024$), weight at presentation (0.61, $p < 0.001$), unavailability of ventilation when required (3.74, $p = 0.009$), unavailability of parenteral nutrition when required (2.95, $p = 0.001$), sepsis on arrival (1.99, $p < 0.001$), additional CA (1.63, $p = 0.001$), surgical site infection (1.62, $p = 0.034$), unavailability of a Surgical Safety Checklist (1.25, $p = 0.014$).

Conclusion: Significant disparities in mortality exist for common gastrointestinal CAs globally. Rapid action is required through a coalition of global stakeholders to eradicate these inequalities.

Keywords: Congenital anomalies, Global paediatric surgery, Management and outcomes

Table 1

	N	Mortality [95% Confidence Interval]		
		LICs	MICs	HICs
Gastroschisis	451	90.0% [87.2-92.8]	32.1% [27.8-36.4]	1.4% [0.3-2.5]
Oesophageal atresia	560	85.7% [82.8-88.6]	29.4% [25.6-33.1]	7.1% [5.0-9.2]
Congenital diaphragmatic hernia	447	-	38.3% [33.7-42.8]	14.2% [11.0-17.4]
Intestinal atresia	678	60.0% [56.3-63.7]	21.3% [18.2-24.4]	3.3% [2.0-4.7]
Anorectal malformation	990	20.0% [17.5-22.5]	12.1% [10.0-14.1]	1.7% [0.9-2.5]
Hirschsprung's Disease	517	11.8% [9.0-14.5]	6.6% [4.5-8.8]	1.9% [0.7-3.0]
Exomphalos (omphalocele)	324	28.6% [23.7-33.5]	20.4% [16.0-24.8]	17.1% [13.0-21.2]

Prior publication/ presentation details: This abstract has been submitted to the following conferences: British Association of Paediatric Surgeons Conference (July 2020, Bruges), Bethune Round Table (May 2020, Canada), KFAFH 15th National Conference (February 2020, Saudi Arabia; National results presentation),

PAAFIS Spring Symposium (April 2020, Tunisia), Turkish National Paediatrics Congress (April 2020), 40th Continuing Medical and Dental Education Conference. Just one slide summarising the mortality for each condition in low-, middle- and high-income countries was shown as part of an invited presentation at the Global Initiative for Children's Surgery Meeting (Jan 2020).

Audio-Visual Presentation

BASCOM'S CLEFT LIFT PROCEDURE IN PILONIDAL SINUS DISEASE, HOW I DO IT?

Pornparpa Meesukcharoensawat, MD, Krittin Kajohnwongsatit, MD

Department of Surgery, Khon Kaen Hospital, Khon Kaen 40000, Thailand

The etiology of Pilonidal sinus disease is unclear but it is associated with ingrown hair that causes infection and abscess. Pilonidal sinus can be the cause of chronic infection. Treatment of pilonidal abscess had many options including conservative treatment and surgery such as Bascom's cleft lift procedure, Karydak's procedure and Limberg flap procedure. The best procedure is controversial, but 88% Bascom's cleft lift procedure was successful in primary healing. Bascom's cleft lift flap is optional for treatment of pilonidal sinus disease to remove pilonidal tract. The scar of Bascom's flap lies just off the midline that can promote wound healing. A 17 years old male presented with 1 year of chronic pain at intergluteal cleft and 3 months prior to admission he found the abscess forming at this area. This abscess had resolved after antibiotic but recurrent

for several times. The plan of treatment was discussed and scheduled for Bascom's cleft lift procedure. The patient was discharged home on the 5th postoperative day and 2 months after operation the surgical wound is completely healed and no postoperative complication. The result of Bascom's cleft lift incision was out of the cleft and off the midline to promote wound healing and less complication.

Keywords: Pilonidal sinus disease, Bascom cleft lift procedure

EVALUATION OF SENTINEL LYMPH NODE BIOPSY WITHOUT FROZEN SECTION IN BREAST CANCER PATIENT FROM COLLECTIVE DATA OF AXILLARY LYMPH NODE DISSECTION ANALYSIS

Maleerat Metula, Sorawat Janwanitchstaporn, Thanakorn Orapan

Department of Surgery, Suratthani Hospital, Suratthani 84000, Thailand

Background: Sentinel lymph node dissection (SLND) have been decreased in early breast cancer fol-

lowing an ACOSOG Z0011 trial. SLND treated did not benefit from axillary lymph node dissection (ALND). So frozen section of sentinel lymph node (SLN) has been decreased significantly.

Objectives: To determine the re-operative rate in the patient that limited SLN metastasis treated and determine factors associated with metastatic involvement of axillary lymph nodes (ALN).

Materials and Methods: Patients who diagnosed early breast cancer and met criteria of ACOSOG Z0011 trial were retrospectively reviewed. All patients were initially treated with total mastectomy, lumpectomy, ALND and SLND from 2014 to 2018 were collected. Demographic data was recorded and the risk of metastasis to ALN were analyzed in relation to clinicopathological determinants. Binary logistic regression was used, yielding odds ratios (OR) with 95% confidence intervals (CI).

Results: 190 early breast cancer patients were enrolled in this study. 19 patients (10%) of patients required ALND. Factors associated with ALN metastasis in univariate analyses were age > 50 year, HER-2 expression, lymphovascular invasion (LVI), and extra nodal extension. All factors identified with univariate analyses were entered into a multivariate logistic regression model and HER-2 expression (OR = 2.54, CI 1.36-4.77, $P = 0.004$), LVI (OR = 3.53, CI 1.88-6.88, $P < 0.001$), and extra nodal extension (OR = 8.11, CI 1.74-37.83, $P = 0.005$) remained as independent factors of ALN metastasis.

Conclusions: In conclusion, the chances of having to re-operation are relatively low. HER-2 expression, LVI and extra nodal extension are factors that associated with ALN metastasis in patient with early breast cancer.

EXTENDED TOTALLY EXTRAPERITONEAL - TRANSVERSUS ABDOMINIS RELEASE (ETEP-TAR) FOR LARGE VENTRAL HERNIA REPAIR

Kanittha Sakolprakaikij, Siripong Chewatanakornkul, Piyanun Wangkulangkul

Department of Surgery, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkhla 90110, Thailand

The interesting case that was presented in the video is a 72-year-old female known case IHD stone who underwent surgery two years ago then developed reducible mass at the surgical wound for 3 months.

Physical examination showed the mirror L wound with the two bulging masses while standing. CT scan showed abdominal wall herniation size 6.4 cm at the mid anterior abdominal wall and the second one size 8.5 cm at the right lateral abdominal wall.

This case has large and multiple ventral hernias, so TAR has shown to be very useful in complex location as a subcostal in this scenario.

At the beginning of the case, the patient was positioned supine with split legs and supported the right back. The surgeon and cameraman stood on the patient's left side with the first assistant on the right. Then each trocar was inserted clockwise consequently. About the steps approach, first is dissection in retrorectus space toward the costal margin cephalad and to the space of Retzius caudally then cross over to the contralateral retrorectus space. Next, release the TA muscle just medially to the neurovascular bundle (TAR). Later sharp dissection of the hernia sac and then approximate the defect of posterior and anterior layers. After that, place the mesh sized extending at least 5 cm beyond the edge of the defect. Lastly, place the drainage above the mesh.

In the postoperative 3 months follow-up, the patient had a good function of the abdominal wall.

LAPAROSCOPIC DIVERTICULECTOMY WITH MYOTOMY AND DOR FUNDOPLICATION

Lalida Rachiwong, Kamthorn Yolsuriyanwong, Siripong Chewatanakornkul

Department of Surgery, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkhla 90110, Thailand

A 62-year-old woman presented with dysphagia, chest pain, and regurgitation for 1 year. The upper GI endoscopy and upper GI study found a 3 cm diverticulum on the right-side wall of the distal esophagus. The CT scan revealed a diverticulum 3.7 cm in diameter. The high-resolution manometry result showed the patient had distal esophageal spasm. The patient was diagnosed as having an epiphrenic esophageal diverticulum accompanied by an underlying distal esophageal spasm. Laparoscopic transhiatal diverticulectomy with myotomy and Dor fundoplication was performed.

The patient was placed in the reverse Trendelenburg position and the surgeon stand on the right side. First of all, mobilized the fundus and exposed to the left crus.

The gastrohepatic ligament was taken down, the right crus were exposed. The vagus nerve was identified and preserved. Place a cord tape around the esophagus for retraction. The esophageal diverticulum was found on the right-side wall located 4 cm above the EGJ. The intraoperative endoscopy was used to assess the level of the diverticulum and clear the contents. The diverticulectomy was performed using the Endo-GIA stapler. The resected diverticulum was removed through the 12-mm trocar. The myotomy was performed at anterior side upward to the neck of diverticulum and extend distally 2 cm at the stomach side. Finally, the anterior Dor fundoplication was performed. The patient's postoperative course was uneventful. The Upper GI study at post-operative day 2 showed no contrast leakage and she was discharged from the hospital 4 days after surgery. The pathologic diagnosis was diverticulum and no evidence of malignancy. At 3 months after surgery, her symptoms had improved. The high-resolution manometry result was improved and the upper GI study showed no evidence of residual epiphrenic diverticulum.

In conclusions, the epiphrenic diverticulum is associated with esophageal motility disorder so the manometry is recommended. The surgical treatment is diverticulectomy with myotomy. Dor fundoplication is the preferable anti-reflux procedure. The laparoscopic approach is safe and feasible.

LONG-TERM SURVIVAL OF REPEAT METASTATIC RESECTION IN RECURRENCE COLORECTAL METASTASES

Krittiyakorn Dongtiamsee, Tharatip Srisuk

Department of Surgery, Faculty of Medicine, Khon Kean University, Thailand

Background: Repeat metastatic resection in colorectal cancer is doubtful about benefits, especially in multiple repeat metastasectomy. Some patients had potential resectability even in second, third, fourth, or fifth repeat metastatic resection. The long-term outcome and risk factors that affected long-term survival were also questionable.

Objective: This study aimed to evaluate the benefit of repeat metastatic resection in colorectal metastases cancer regarding long-term survival.

Materials and Methods: We collected data of

metastases colorectal cancer patients in Srinakarin Hospital from 1 January 2006 to 1 January 2017. Then we selected only patients who underwent the second metastasectomy to access the data. We analyzed the survival rate and the factors that affected survival. The survival of third, fourth, and fifth repeat metastasectomy was also assessed.

Results: The first colorectal metastasectomy was liver in 169 patients. There are only 16 patients were suitable for underwent the second metastasectomy. The second metastasectomy were liver (n=11), liver with portal vein (n=1) liver with lung (n=1), IMA lymph node (n=1), liver with spleen (n=1), liver with diaphragm (n=1). There are four patients underwent the third metastasectomy. Three patients underwent fourth metastasectomy. Only one patient survived for the fifth metastasectomy. The overall survival after the second metastasectomy was shown as median survival time 5.01 years (95% CI 3.95-6.07). Survival probability after underwent the second metastasectomy in the first year was 93.75% (95% CI 63.23-99.10). At five years, the survival probability after the second metastasectomy was 57.44% (95% CI 22.32-81.46).

Conclusion: The second metastasectomy tends to have the benefit and good long-term survival outcome. These could be an option for the treatment of multiple recurrences of colorectal cancer in selected patients.

OUTCOME OF NON-OPERATIVE MANAGEMENT OF SPLENIC INJURY

Thanapon Supapon, Supparerk Prichayudh

Department of Surgery, Faculty of Medicine, Chulalongkorn University, Pathumwan, Bangkok 10330, Thailand

Background: The spleen is one of the most commonly injured organs following abdominal trauma. A widespread shift to non-operative management (NOM) for splenic injuries has been observed in most centers worldwide. Thus, the purpose of this study is to report our experience in treating patient with splenic injuries with NOM at a King Chulalongkorn Memorial Hospital.

Objective: The aim of this study is to describe the demographics, mechanisms of injury, management and outcomes in patients who suffered splenic trauma in King Chulalongkorn Memorial Hospital.

Materials and Methods: A retrospective study

included all splenic injury patients admitted to King Chulalongkorn Memorial Hospital between January 2009 and January 2019.

Results: A total of 106 patients were included, with a median age of 31.5 years. Of these, 91 patients (85.8%) had blunt injuries. Fifty-seven (59.8%) had high-grade injuries. A total of 43 (40.6%) patients were managed with observation, 1 (2.3%) patient had radiological intervention, 4 (3.7%) patients were managed with splenic salvage operation and 59 (55.7%) patients had splenectomy. Patients who died were significantly more likely to be multiple organ injuries.

Conclusion: Splenic injuries have shown a steady increase in the last decade. Splenectomy rates have decreased in favor of non-operative techniques. Radiological intervention with splenic artery embolization was successful in all selected patients with high-grade injuries.

Keywords: Non-operative management, Spleen, Trauma

ROBOTIC ASSISTED VATS ENUCLEATION VAGUS NERVE SCHWANNOMA

Gritin Gonggetyai, Jirawat Swangsri

Department of Surgery, Faculty of Medicine, Siriraj Hospital, Bangkok Noi, Bangkok 10700, Thailand

Schwannoma is a rare form of tumor originating from nerve sheath fiber. Mediastinal vagus schwannoma is extremely rare. These tumors are usually asymptomatic, however, some patients have dysphagia and chest pain. The treatment of choice is resection. Thoracotomy has been traditional approach with significant morbidity. VATS seem to provide more advantages than open technique. However, VATS have limitation such as its rigidity and limited vision. Robotic approach offers less invasiveness with precise dissection.

Our 55-year-old patient presented with dysphagia. CT scan shown well-defined enhancing mass 3.2 x 1.8 x 3.4 cm. abutting right thoracic esophagus. EUS&FNA was performed and shown spindle cell neoplasm with neural differentiation. Provisional diagnosis was sub-epithelial lesion of esophagus. We set OR for Robotic assisted VATS enucleation. Da Vinci surgical system Xi was used. Intraoperative finding revealed the mass originated from vagus nerve. The tumor was removed

carefully without esophageal violation. In postoperative period the patient dramatically recovered and tolerated soft diet well and discharged on post op day 3. The final pathological diagnosis was benign peripheral nerve sheath tumor without malignant transformation.

This VDO promotes the advantage of robotic approach. The lesion located in the mediastinum adjacent to esophagus. The operative field was restricted by the confine of chest wall and surrounded organ which limited mobilization. Robotics approach overcome these limitations from its flexibility and intuitive movement. It affords more range of motion and easier manipulation compares with traditional VATS.

The Robotic assisted surgery could optimize surgical outcome of intrathoracic lesion including patient's safety and completeness of surgery.

Keywords: Schwannoma, Vagus, Robotic

THE PREVALENCE OF INCIDENTAL THYROID CARCINOMA IN PATIENT WHO UNDERWENT THYROIDECTOMY FOR BENIGN THYROID DISEASE IN SURATTHANI HOSPITAL

Supanna Wuttiworapan, MD, Thanakorn Orapan, MD

Department of Surgery Suratthani Hospital, Suratthani 84000, Thailand

Background: Incidental thyroid cancer is a term applied to unsuspected cancer identified incidentally on pathologic examination of thyroid tissue removed for benign disease and it is quite high as been reported.

Objective: This study aims to evaluate the prevalence of incidental thyroid carcinoma (ITC) after thyroidectomy for benign thyroid disease and determine the clinical, imaging finding and pathological factors that correlated to the thyroid carcinoma.

Materials and Methods: Patients who underwent thyroid surgery for benign thyroid diseases from 4 January 2015 to 6 June 2016 were retrospective reviewed. Patients with preoperative cytology showed follicular lesion were excluded. Demographic data was recorded and factors that correlated to thyroid carcinoma were analyzed. Binary logistic regression was used, yielding odds ratios (OR) with 95% confidence intervals (CI).

Results: In our study, 211 patients underwent thyroidectomy and the incidence of incidental thyroid carcinoma was found in 23 (11.5%) patients.

Almost all of the factor's studies were related to thyroid carcinoma in univariate analysis. All factors identified with univariate analyses were entered into a multivariate logistic regression model and we founded that ultrasonography finding remained as independent factors of thyroid carcinoma.

Conclusion: Incidental thyroid carcinoma is always present, therefore an accurate diagnosis is important. A careful selection of nodules for FNA cytology on the basis of ultrasonography finding, could better select the choice of operation.

Keywords: Incidental thyroid carcinoma

Resident Paper Award

5-YEAR OUTCOME FOR ENDOLEAK TYPE 2 AFTER ENDOVASCULAR TREATMENT IN ABDOMINAL AORTIC ANEURYSM IN SONGKLANAGARIND HOSPITAL

Chonpisith Chodchoy, Wittawat Tantarattanapong, Dhanakom Premprabha

Department of Surgery, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkhla 90110, Thailand

Background: Elective abdominal aortic aneurysm (AAA) repair is recommended for aneurysms greater than 5.5 cm, symptomatic, or rapidly expanding more than 0.5 cm in 6 months. 75% of AAAs are treated with endovascular treatment (EVAR) rather than open repair. Type II is the most common type of endoleaks and can potentially enlarge and pressurize the aneurysm sac with a risk of rupture. However, type II endoleaks spontaneously resolve or never lead to sac enlargement.

Objective: To study the incidence rate of endoleak type 2 in patients with abdominal aortic aneurysm treated with endovascular procedures. The results in Songklanagarind Hospital last 5 years.

Materials and Methods: Retrospective studies in patients receiving abdominal aortic aneurysm treatment using elective endovascular repair, from January 2012 - December 2016 and have followed up for 2 years to evaluate the incidence of endoleak type II and physical factors that are related to the occurrence of leaks.

Results: In 2012-2016, there was a collection of data of patients diagnosed with aneurysm that had elective surgery. A total of 250 patients underwent surgery, with an average age was 76 (70,80) years, representing 194 males (77.6%). The average size of aneurysms is 6 centimeters and the incidence of endoleak type II was 73 people (29%). In related factors, Dyslipidemia is likely

to cause a significant endoleak type II ($P < 0.001$). At the same time, it is found that in the first year after surgery, there is a chance of endoleak type II.

Conclusion: In Songklanagarind Hospital, there was an endoleak type II 29% and found that the risk of dyslipidemia is related to the endoleak type II.

AORTIC ROOT REPLACEMENT IN PATIENTS WITH MARFAN SYNDROME: A COMPARISON OF COMPOSITE VALVE GRAFT REPLACEMENT VERSUS VALVE-SPARING AORTIC ROOT REPLACEMENT

Chinaphum Vuthivanich, Mueanthep Chomvilailuk, Chayatat Sirinawin, Nopporn Pornpatrtanarak, Chanapong Kittayarak, Jule Namchaisiri, Seri Singhatanadgige, Pat Ongcharit, Vichai Benjacholamas

Cardiovascular and Thoracic Surgery Unit, King Chulalongkorn Memorial Hospital, Bangkok, 10330, Thailand

Background: Aortic root replacement improves survival in patients with Marfan syndrome (MFS) with aortic root disease. Composite valve graft replacement (CVG) and valve-sparing aortic root replacement (VSRR) both show favorable mid and long-term outcomes.

Objectives: The purpose of this study was to evaluate the early and late clinical outcomes after CVG and VSRR in patients with Marfan syndrome.

Materials and Methods: Marfan syndrome patients who had the CVG or VSRR at King Chulalongkorn Memorial Hospital between August 1999 and August 2019 were identified. Follow-up information was obtained from hospital charts and telephone contact. Kaplan-Meier survival analyses were performed. The mean follow-up time was 7 years.

Results: Thirty-seven adult (age > 15 years) patients with Marfan syndrome had either CVG (n=24) or VSRR (n=13) procedures. CVG patients had more aortic root dissection (62.5% vs 23.1%, $p = 0.022$), shorter aortic cross-clamp time (120 vs 175 minutes, $p = 0.007$) and shorter cardiopulmonary bypass time (161 vs 216 minutes, $p = 0.042$). In-hospital mortality was 4.2% (n=1) in patients undergoing CVG and 0% in patients undergoing VSRR ($p = 1.0$). Ten-year survival was 75.0% in patients undergoing CVG and 92.3% in patients undergoing VSRR ($P = 0.06$). Freedom from reoperation on aortic valve or root was higher in patients undergoing CVG compared to VSRR (100% vs 61.5%, $p = 0.004$). There was no case of endocarditis detected during follow-up. There was no significant difference in long-term survival and freedom from thromboembolic or hemorrhagic complication between the 2 procedures.

Conclusions: After aortic root replacement in patients with Marfan syndrome, patients undergoing CVG had worse survival outcome compared to VSRR but not statistically significant. Lower late survival among CVG patients probably reflects the preferential use of the CVG procedure for higher risk patients. CVG have similar freedom from thromboembolic or hemorrhagic complication but higher freedom from reoperation on aortic valve or root compared to VSRR.

Keywords: Aortic root replacement, Marfan syndrome, Composite valve graft replacement, Valve-sparing aortic root replacement, Survival outcome

COMPARISON OF ICED LIDOCAINE AND SPRAYING LIDOCAINE IN PATIENTS UNDERGOING ESOPHAGOGASTRODUODENOSCOPY (EGD): A PROSPECTIVE RANDOMIZED CONTROLLED TRIAL

Nanthawat Talalak, Prasit Mahawongkajit

Department of Surgery, Faculty of Medicine, Thammasat University, Klong Luang, Pathumthani 12120, Thailand

Background: Esophagogastroduodenoscopy (EGD) is a common diagnostic intervention which is performed under topical anaesthesia, while spraying lidocaine is a conventional technique which is widely used before endoscopic procedures. We found that most of the patients had unpleasant symptoms and were annoyed by the conventional technique. Recent data suggest that

pre-cooling the injection site prior to local anaesthetic injection can reduce the pain and discomfort in dental surgery. The iced lidocaine may improve patient satisfaction during endoscopy and enhance the quality of the procedure.

Objective: This study aimed to compare the effectiveness and patients' tolerance using the iced lidocaine and spraying for patients undergoing unsedated EGD.

Materials and Methods: We enrolled a total of 80 patients who were indicated for EGD. Patients were randomized to either iced lidocaine or conventional spraying lidocaine and underwent EGD by one endoscopist. After the endoscopic procedure, the endoscopist and patients would fill in a questionnaire rating the gag reflex and satisfaction respectively.

Results: Patients were equally randomized between the spraying lidocaine and iced lidocaine groups. The iced lidocaine group showed significantly less gag reflex, greater ease for esophageal instrumentation and also recorded improved patient and endoscopist satisfaction ($P < 0.05$). However, both groups were equal in quality of EGD, time of EGD and completion of the procedure without requiring sedation.

Conclusion: Both iced lidocaine and spraying lidocaine are safe, effective options for upper gastrointestinal endoscopy. We support the claim that iced lidocaine could be valuable for local oropharyngeal anaesthesia for EGD.

DETECTION OF DELAYED PANCREATIC FISTULA BY DRAIN AMYLASE LEVEL AFTER PANCREATICODUODENECTOMY

Pitikorn Srianakkawanich¹, Nan-ak Wiboonkhwan¹, Tortrakoon Thongkan¹, Thakerng Pitakteerabundit¹, Osaree Akaraborworn²

¹ Department of Surgery, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkhla 90110, Thailand

² Trauma Unit, Department of Surgery, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkhla 90110, Thailand

Background: Pancreaticoduodenectomy is a complex, high risk surgical procedure performed for periampullary cancer and other periampullary disease. The duration of postoperative intraabdominal drain insertion still remains controversial. Some studies suggest to remove the drain on the postoperative day (POD) 3 if the

patient has no postoperative pancreatic fistula (POPF). However, some patients occur POPF after POD 3 that we define as delayed POPF.

Objectives: Primary outcome is to determine the incidence of delayed POPF in post-pancreaticoduodenectomy patients. Secondary outcome is to identify the risk factors related to delayed POPF and the postoperative complications.

Materials and Methods: All adult patients (n=60) who underwent pyloric-resecting pancreaticoduodenectomy (PRPD) in Songklanagarind Hospital by single hepatobiliary and pancreatic surgery team between 1st Aug 2017 and 31th May 2020 were enrolled in this study. The drain amylase was collected on POD 1, 3, 5 and 7. We stratified the patients into 3 groups: early POPF, delayed POPF and none of POPF. The postoperative complications in the 3 groups were compared.

Results: The overall incidence of clinically relevant POPF (CR-POPF) is 6.67%. The incidence of early POPF and delayed POPF are 21.67% (grade A 76.92%, grade B 23.08%) and 11.67% (grade A 85.71%, grade B 14.29%), respectively. There is no significant difference in risk factors associated with delayed POPF and postoperative complications among the three groups of patients.

Conclusion: The incidence of delayed POPF is high, and the extended duration of the intraabdominal drain to POD 7 is valuable in terms of early diagnosis of delayed POPF. It may attribute to decreasing the incidence of clinical-related POPF. Further study is needed to identify the risk factors associated with delayed POPF.

Keywords: Postoperative pancreatic fistula, Delayed pancreatic fistula, POPF, Drain amylase, Pancreaticoduodenectomy

EFFECTIVENESS OF THE TREATMENT OF INTERNAL HEMORRHOID GRADE 2-3 WITH RUBBER BAND LIGATION AND SCLEROTHERAPY COMPARE WITH RUBBER BAND LIGATION ALONE

Khanjanin Pattaropong, Worrawit Wanitsuwan

Department of Surgery, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkhla 90110, Thailand

Background: The internal hemorrhoid is one of the common problems and some are able to treated with office-based procedure. High effectiveness procedure can decrease the rate of surgical treatment.

Objective: This study aimed to assess the effectiveness of the office-based procedure in internal hemorrhoid grade 2-3 treatment, compare the recurrence rate between rubber band ligation (RBL) alone and RBL combined with sclerosing therapy.

Materials and Methods: All patients diagnosed with internal hemorrhoid grade 2-3 at Surgical Clinic of Songklanagarind Hospital and had the hemorrhoid treatment; RBL alone or RBL combine with sclerosing injection, between 1st August 2012 and 31st July 2017. Recurrence rate was determined and compared between both groups.

Results: This study included 300 patients with an average age of 57.5 years. RBL combined with sclerosing injection was the most common procedure performed (n = 192, 64%) followed by RBL alone (n = 108, 36%). There were 180 patients (60%) with internal hemorrhoid grade 2 and 120 patients (40%) with internal hemorrhoid grade 3. The RBL combined with sclerosing injection group had lower 3 months and 12 months-recurrence rates compared with RBL alone group (For 3 months; 18 (9.7%) vs. 33 (30.6%), $p < 0.001$ and for 12 months; 42 (21.9%) vs. 45 (41.7%), $p < 0.001$). In internal hemorrhoid grade 2, patients in RBL combined with a sclerosing injection group had significantly lower 3 months-recurrence rate compared with RBL alone (6.2% vs. 20.6%, $p = 0.008$). For the patient with internal hemorrhoid grade 3 that received RBL combined with the sclerosing injection had significantly lower 3 and 12 months-recurrence rate compared with RBL alone (13.8% vs. 47.5%, $p < 0.001$ and 27.5% vs. 65%, $p < 0.001$ respectively).

Conclusion: RBL combined with sclerosing injection had more effectiveness for internal hemorrhoid grade 2 and 3 compared with RBL alone and had a low recurrence rate at 3 and 12 months.

Keywords: Internal hemorrhoid, Hemorrhoid, Rubber band ligation, Sclerotherapy, Office-based procedure

FAST ACCURACY IN MAJOR PELVIC FRACTURES FOR DECISION-MAKING OF ABDOMINAL EXPLORATION: SYSTEMATIC REVIEW AND META-ANALYSIS

Chunlaches Chaijareenont¹, Chonlada Krutsri², Preeda Sumpritpradi², Pongsasit Singhatas², Tharin Thampongsa², Panuwat Lertsithichai¹, Pattawia Chai-krua³, Napaphat Poprom¹

¹Department of Surgery, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

²Division of Trauma Surgery and Surgical Critical Care, Department of Surgery, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

³Surgical Research Unit, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

Background: Major pelvic fractures are often associated with intra-abdominal organ injuries. Considering patients' hemodynamic status, Focused Assessment with Sonography for Trauma (FAST) can facilitate decision-making for abdominal exploration. Non-therapeutic exploratory laparotomy from pelvic fractures should be avoided. Aim of this study is to determine the accuracy of FAST in diagnosing significant intraabdominal hemorrhage that leads to determine whether or not to pursue therapeutic abdominal exploration in patients with major pelvic fractures.

Materials and Methods: We systematically reviewed the PubMed and SCOPUS databases from 2009 to 2019 and also using a retrospective review of patients admitted to the Acute Care Surgery service at Ramathibodi Hospital from 2016 to 2019. We performed a meta-analysis by using a random effects model.

Results: A total 677 patients were analyzed. Mean patient age was 40.8 years. Leading mechanism of injury were motor vehicle collision (44.72%), fall from height (13.41%), and motorcycle collision (13.69%). Average injury severity score (ISS) was 32.5 (range: 24.1–50), and overall mortality rate was 11.65%. The pooled sensitivity, specificity, and accuracy of FAST to identify significant intra-abdominal hemorrhage was 79%, 90%, and 93%, respectively (95% confidence interval: 89%–94%). Meta-regression revealed no significant correlation between injury severity score and the accuracy of FAST.

Conclusion: Our meta-analysis revealed that FAST in major pelvic fracture accurately detected significant intra-abdominal hemorrhage. Using FAST in the presence of unstable hemodynamics, we can decide to perform abdominal exploration with the expectation of finding significant intra-abdominal hemorrhage require surgically control.

Keywords: Abdominal injury, Trauma, Major pelvic fracture, Unstable pelvic fracture, FAST

LONG TERM COURSE AFTER PEDIATRIC RIGHT VENTRICULAR OUTFLOW TRACT RECONSTRUCTION

Pimchanok Junnil¹, Chalit Cheanvechai¹, Jule Namchaisiri¹, Ankavipar Saprungruang², Puwadon Thitivaraporn³, Mueanthep Chomvilailuk¹, Vichai Benjacholamas¹

¹ Cardiovascular and Thoracic Surgery Unit, Department of Surgery, King Chulalongkorn Memorial Hospital, Chulalongkorn University, Bangkok, Thailand

² Pediatric Cardiology Unit, Department of Pediatric, King Chulalongkorn Memorial Hospital, Chulalongkorn University, Bangkok, Thailand

³ Department of Cardiovascular and Thoracic Surgery, Charoengkrun Pracharak Hospital, Bangkok Metropolitan Administration, Bangkok, Thailand

Background: Valved homografts have been the most commonly used valved conduit for RVOT reconstruction. However, they lack durability. Early results with homografts have been good.

Objectives: This study was designed to compare single center results of 143 RVOT conduit implantations for determining patient survival, graft failure rate, reoperation rate, and risk factors associated with reoperation.

Materials and Methods: All pediatric patients who underwent RVOT conduit implantations between January 2006 and December 2018 were reviewed. We stratified conduits by aortic, pulmonic homograft and Contegra and analyzed the role of patient sex, age, diagnosis, graft size. End points included freedom from graft failure, freedom from reoperation, and patient survival.

Results: 74 aortic homografts, 61 pulmonic homografts and 8 Contegra conduits were implanted for RVOT reconstruction. Median age at implantation was 3 years. The primary diagnosis was truncus arteriosus (41.3%). Survival rate was 83.2% at 10 years. Freedom from graft failure at 2,5,10 years was 100%, 97.9%, and 63.4%. Freedom from reoperation at 10 years was 85.8% for pulmonic homograft, 74.9% for aortic homograft and no reoperation for Contegra group during 6 years of follow up. Multivariable analysis identified only conduit diameter < 18 mm as risk factor for reoperation [HR 3.16 (1.38-7.23), $P = 0.007$]. Younger age, sex, conduit type or diagnoses were not risk factors.

Conclusion: Homograft valve used for RVOT reconstruction provided excellent long-term durability

and late survival. The factor that adversely affected graft longevity was smaller graft size (diameter < 18 mm). Reoperation for conduit failure was not significantly different between the groups.

Keywords: Right ventricular outflow tract, Homograft, Conduit failure, Contegra

PREDICTION OF SEROMA AFTER TOTAL MASTECTOMY USING AN ARTIFICIAL NEURAL NETWORK ALGORITHM

Panupong Nakchuai¹, Suphakarn Techapongsatorn¹, Pakkapon Sukvibul¹, Amarit Tansawet¹, Sermkiat Lolak²

¹ Department of Surgery, Faculty of Medicine Vajira Hospital, Naramitradhiraj University, Thailand

² Department of Clinical Epidemiology and Biostatistics, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Thailand

Background: Seroma is a common complication after mastectomy. To the best of our knowledge, however, none of the prediction models has been developed.

Objective: To develop a seroma prediction model using a machine learning algorithm.

Materials and Methods: Medical records of total mastectomy patients were retrospectively reviewed. Data consisting of 120 subjects were divided into a training-validation data set (96 subjects) and a testing data set (24 subjects). Data were learned by a 9-layer artificial neural network (ANN), and the model was validated using 10-fold cross-validation. The model performance was assessed by the confusion matrix in the validating data set. The receiver operating characteristic curve was constructed, and the area under the curve (AUC) was also calculated.

Results: Pathology type, presence of hypertension, presence of diabetes, receiving of neoadjuvant chemotherapy, body mass index, and axillary lymph node (LN) management (i.e., sentinel LN biopsy and axillary LN dissection) were selected as a predictive factor in a model developed from neural network algorithm. The model yielded AUC of 0.760, corresponding with a level of acceptable discrimination. Sensitivity, specificity, accuracy, and positive and negative predictive values were 100%, 52.9%, 66.7%, 46.7%, and 100%, respectively.

Conclusions: Our model, which developed from the ANN algorithm can predict seroma after total mas-

tectomy. Our model is suitable for screening because of its high sensitivity. Nevertheless, external validation is needed to confirm the performance of this model.

Keywords: Seroma, Mastectomy, Breast cancer, Artificial neural network

PREDICTIVE FACTORS OF THREE OR MORE POSITIVE AXILLARY LYMPH NODES IN PATIENTS DIAGNOSED WITH EARLY BREAST CANCER IN SONGKLANAGARIND HOSPITAL

Noppawan Thitiworakarn, Srila Samphao, Somrit Mahattanobol, Wongsakorn Chaochankit

Department of Surgery, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkhla, Thailand

Background: Sentinel lymph node biopsy (SLNB) is a standard axillary staging in clinically node negative early breast cancer. Intraoperative frozen section of SLNs can help avoiding the second operation for completion axillary lymph node dissection (ALND) in case of ≥ 3 nodes involvement, according to ACOSOG Z-0011 trial. However, this process takes more times, needs pathologists and increases cost. This study was decided to investigate if clinicopathological factors can predict high-risk patients of having ≥ 3 positive ALNs, thus intraoperative frozen section would be required in this group and avoided in low-risk patients.

Objective: To identify predictive factors of ≥ 3 ALN involvement in early breast cancer.

Materials and Methods: The data were retrospectively collected from 758 early breast cancer patients (cT1-2, N0, M0) who underwent breast and axillary surgery between January 2008 and December 2018 in Songklanagarind Hospital. Patient age, clinical tumor size, operative procedures and tumor characteristics were collected and analyzed.

Results: Of 758 patients, 57 (7.5%) had ≥ 3 positive ALNs. Mean age at diagnosis was 53.2 years (16-93). Mean tumor size was 2.0 cm (0.1-5.0). Univariate analysis showed that pathological tumor size (OR 1.85, 95% CI 1.07-3.18 $p = 0.03$) and presence of lymphovascular invasion (LVI) (OR 4.93, 95% CI 2.83-8.58, $p < 0.001$) were predictive factors of ≥ 3 ALN involvement. For multivariate analysis, only presence of LVI (OR 4.98, 95% CI 2.73-9.08, $p < 0.001$) was a strong predictive factor of ≥ 3 ALN involvement.

Conclusion: Only a small number of patients will have ≥ 3 ALN involvement in early breast cancer. SLNB could be performed without intraoperative frozen section. Patients with a presence of LVI in the primary tumor on core needle biopsy should be considered the intraoperative SLN frozen section.

Keywords: Early breast cancer, Intraoperative frozen section, Sentinel lymph node biopsy, Axillary lymph node involvement

SENTINEL LYMPH NODES BIOPSY AFTER NEOADJUVANT TREATMENT OF BREAST CANCER USING RADIOISOTOPE VS ISOSULFAN BLUE VS INDOCYANIN GREEN FLUORESCENCE: PROSPECTIVE COHORT STUDY

Tanet Chatmongkonwat, MD, Prakasit Chirappapha, MD, Panuwat Lertsithichai, MD

Subdivision of Surgical Oncology, Department of Surgery, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok 10400, Thailand

Background: Dual technique sentinel lymph node biopsy is the standard in post neoadjuvant treatment. However, many hospitals are not equipped to use radioisotopes. Here we investigate the detection rate and accuracy of sentinel lymph node biopsy in post neoadjuvant treatment breast cancer, comparing radioisotope, isosulfan blue, and indocyanine green (ICG) approaches.

Objective: We investigate the detection rate and accuracy of sentinel lymph node biopsy in post neoadjuvant treatment breast cancer, comparing radioisotope, isosulfan blue, and indocyanine green (ICG) approaches.

Materials and Methods: This prospective study includes breast cancer patients (T2–4, N1–2) after neoadjuvant treatment. Patients who allergy to ICG, isosulfan blue or radioisotope were excluded from the study.

Results: Between 1 July 2019 to 31 March 2020. The mean age of participants was 53 years. The clinical-stage was: 2A (8.7%), 2B (34.78%), 3A (43.48%), and 3B (13.04%). The detection rates at the individual level were 95.23% with ICG, 85.71% with isosulfan blue, and 85.71% with a radioisotope. The detection rate increased up to 100% when combine ICG and blue dye. The FNRs of sentinel lymph node biopsy at the individual level were: 10% using ICG, 30% using isosulfan blue, and 40% using radioisotope. At the lymph node level,

the detection rates were 93.22%, 81.78% and 53.87% respectively. The FNRs of sentinel lymph node biopsy at the lymph node level were 19.05%, 21.43%, and 18.03% respectively. However, the FNR was less than 10% when ICG, isosulfan blue, and a radioisotope were combined.

Conclusion: We can perform sentinel lymph node biopsy by combining blue dye with ICG as an optional modality and achieve a comparable outcome with combine radioisotope in locally advanced breast cancer after neoadjuvant treatment.

SUCCESS RATE OF LIMB-SALVAGE SURGERY AFTER ARTERIAL INJURY OF LOWER EXTREMITIES IN PRINCE OF SONGKLA UNIVERSITY

Supaphat Kongsupapsiri¹, Osaree Akaraborworn², Burapat Sangthong², Komet Thongkhao²

¹ Department of Surgery, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkla 90110, Thailand

² Trauma Unit, Department of Surgery, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkla 90110, Thailand

Background: Lower extremities arterial injury lead to high morbidity. The number of patients with lower vascular injury is still high especially in southern of Thailand. We have fewer reports about these and limb-salvage surgery is not suitable for all patients.

Objective: This study aims to clarify the success rate of limb salvage surgery in patients with lower extremities arterial injury, associated factors and outcomes.

Materials and Methods: This retrospective study of lower extremities arterial injury patients that received treatment in Prince of Songkla University from 2013–2017. Patients were classified into limb salvageable group and amputation group. Demographics, comorbidities, injury, operative data and complications were collected. Comparisons of limb salvageable and associated factors were analyzed using the Pearson chi-square or Fisher's exact test. Logistic regression analysis was performed to evaluate factors that may be associated with amputation.

Results: 93 patients, 59 (63%) patients were successful in limb salvage surgery. The common site of injury was popliteal artery (49%) and Superficial femoral artery (16%) respectively. We found significant associated factors to limb salvageable such as blunt mechanism

(limb salvageable group, 50.8%; amputation group, 76.47% $P = 0.01$), multiple injuries (limb salvageable group, 15.25%; amputation group, 35.29% $P = 0.04$), complex fractures (limb salvageable group, 39.13%; amputation group, 15.63% $P = 0.02$) and smoking (limb salvageable group, 39.13%; amputation group, 15.3% $P = 0.04$). After multivariate analysis, blunt mechanism injury is only the predictive factor for amputation (OR, 5.2; 95% CI 1.40-19.06; $P = 0.01$). The common complications were surgical site infection (limb salvageable group, 20.34%; amputation group, 35.29% $P = 0.142$) and fail to perform skin closure of fasciotomy wound (limb salvageable group, 39.13%; amputation group, 15.63% $P = 0.02$).

Conclusion: Most patients with lower extremities vascular injury were successful in limb salvage surgery. However, our study found a higher amputation rate compared with previous studies. Limb salvageable was associated with blunt mechanism, multiple injuries, smoking and complex fractures.

Keywords: Limb salvage surgery, Lower extremities arterial injury, Amputation

SURVIVAL OUTCOME IN CRITICALLY ILL PATIENT RECEIVING EXTRACORPOREAL MEMBRANE OXYGENATION SUPPORT: EARLY EXPERIENCE FROM A UNIVERSITY HOSPITAL IN THAILAND

Sasitorn Sakkarat, Pongsanae Duangpakdee, Voravit Chittithavorn, Surasak Sangkathat

Department of Surgery, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkhla 90110, Thailand

Objective: Extracorporeal membrane oxygenation (ECMO) is a relatively new technology used for life support in patients with cardiopulmonary failure from various causes. Objective of this study is to review the first 5-year experience in adopting this technology to an intensive care unit of a teaching hospital in southern Thailand.

Materials and Methods: Data of ECMO-supported patients in Songklanagarind Hospital, from the years 2014-2018, were retrospectively reviewed. Data sources were from electronic medical record and database of the perfusion service. Parameters in-focus included prior conditions and indications of ECMO, type of ECMO

and cannulation method, complications during and after the treatment and discharge statuses.

Results: A total of 83 patients received ECMO life support during the 5-year period. and the number of cases per year was increasing. The proportion of VV:VA ECMO in our institute was 49:34 cases and there were 3 cases who used ECMO as a part of cardiopulmonary resuscitation. There were 57 cases who used ECMO for cardiac failure when 26 cases were for respiratory causes. Premature withdrawal was decided in 26 cases (31.3%). Overall survival from ECMO was 35/83 cases (42.2%) and survival to discharge was 32/83 (38.6%). During therapy, ECMO could restore serum pH to normal range in all cases. Those who used ECMO for respiratory failure had significantly higher survival probability (57.7%) when compared to the cardiac counterpart (29.8%, p -value 0.03). Patients with younger age had significantly better survival outcome. Most common complications were cardiac (75 cases, 85.5%), followed by renal (45 cases, 54.2%) and hematologic system (38 cases, 45.8%). In those who survive to discharge, average ECMO duration was 9.7 days.

Conclusion: Extracorporeal life support is a technology that bridge the patients with cardiopulmonary failure to their recovery or definitive surgery. Despite of high complication rate, survival can be expected, especially in respiratory failure cases and relatively young patients.

Keywords: Extracorporeal membrane oxygenator, Life-support

THE ASSOCIATION OF SOUTHERN THAILAND METEOROLOGICAL CONDITIONS WITH ACUTE AORTIC EVENT IN SONGKLANAGARIND HOSPITAL

Chidchanok Martmarn, Dhanakom Premprabha, Alan Frederick Geater

Department of Surgery, Prince of Songkla University, Hat Yai, Songkhla 90110, Thailand

Background: Recent studies have reported a significant correlation between meteorological condition and acute aortic events. The studies reveal that the seasonal variation and meteorological parameters impact acute aortic event with the highest occurrence in winter and at low atmospheric pressure. The aim of this study was investigated correlation between meteorological

condition and acute aortic event in the Southern region of Thailand which lie in the tropical zone of the world.

Materials and Methods: Descriptive and retrospective study. The patients with acute aortic events are retrieved 233 patients from Songklanagarind Hospital database between January 1st, 2012 and December 31st, 2016. Daily meteorological conditions of southern Thailand throughout in 5 years were retrieved and merged with patient database in a time-series dataset. The correlation between the incidence of acute aortic events and meteorological condition was analyzed using cross-correlation and Poisson modeling. East and west coast were analyzed separately.

Results: 233 acute aortic events were identified, 130 patients with ruptured aortic aneurysm and 103 patients with acute aortic dissection. Acute aortic events steadily increased over the period 2012 -2016. Cross correlation study revealed no association between acute aortic events and meteorological condition on the west coast, but a significance cross correlation with maximum wind speed on the east coast. The highest correlation was seen at Lag day 6 [Lag day 6; Coef 0.084, *p*-value 0.018, (95% CI .016, 0.154)]. Poisson regression using standardized value of maximum wind speed suggest that an increase daily maximum wind speed from lowest to highest was association with increased incidence rate of acute aortic event 1.18 times [stdwindmax Lag day 6; IRR 1.186, *p*-value 0.018, (95% CI 1.03-1.37)].

Conclusion: The meteorological condition of southern east coast, namely maximum wind speed and 6 days before the day of event is associated with an increased incidence rate of acute aortic events.

Keywords: Meteorological condition, Acute aortic dissection, Ruptured aortic aneurysm, Thailand, Songklanagarind Hospital

THE EFFECT OF CILOSTAZOL IN REDUCING PERIVENOUS-ANASTOMOSIS NARROWING OF UPPER EXTREMITY ARTERIOVENOUS GRAFT FOR HEMODIALYSIS – RANDOMIZED CONTROLLED TRIAL

Chana Pattarasuktawil, MD¹, Suthus Horsirimanont, MD¹, Chaowanun Pornwaragorn, MD¹, Tanapong Panpikoon, MD², Piyanut Pootracoool, MD¹, Wiwat Tirapanich, MD¹, Sapon Jirasiritum, MD¹, Surasak Leela-Udomlipi, MD¹, Nutsiri Kittitirapong, MD¹

¹ Vascular and Transplant Division, Department of Surgery, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

² Department of Radiology, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

Objective: Venous anastomosis stenosis is the most common cause of poor arteriovenous graft (AVG) flow leading to AVG thrombosis. The major cause of venous anastomosis stenosis is neointimal hyperplasia. Cilostazol, Phosphodiesterase III inhibitor, have been proved in reducing neointimal hyperplasia and prevent restenosis after coronary angioplasty and peripheral arterial revascularization. This study is designed for proving the effect of Cilostazol in reducing the stenosis in AVG for hemodialysis patients.

Materials and Methods: The triple-blinded randomized controlled trials were conducted in Ramathibodi Hospital from January 2019 to January 2020. Sixty new-created upper extremity AVG were enrolled in the study and divides into Cilostazol group and Placebo group. In Cilostazol group, patients received cilostazol 100 mg per day for 1 month then continued with 200 mg per day compare with Placebo group. The primary end point was the percent change of venous outflow diameter measured by Duplex ultrasound at 4 weeks and 12 weeks. The secondary end point was primary patency, graft failure, complication and compliant.

Results: Sixty ESRD patients were allocated to Cilostazol group (N=28) and Placebo group (N=33). The Characteristic information were not different. The percent mean residual lumen at 4 weeks in Cilostazol group is 68.06 + 17.041% compare Placebo group 72.58% + 16.353 (*p* = 0.429) and 12 weeks in Cilostazol group are 75.161 + 18.299 % compare Placebo group 74.08 + 16.353% (*p* = 0.884). Significant venous outflow stenosis (using PSV ratio criteria at 12 weeks) occurred 2 cases in Cilostazol group and 4 cases in Placebo group (*p* = 0.99). The surgical-related complication, adverse drug reaction and compliance were no statistically significant different.

Conclusions: This study showed cilostazol could not reduce venous outflow stenosis in short terms follow-up, the longer follow-up in medium to long term outcome study are needed. However, Cilostazol is safe to use in hemodialysis patient.

Keywords: Perivenous-anastomosis, Arteriovenous graft (AVG)

THE OMENTAL LYMPH NODE MAPPING PROJECT

Wasan Janetanakul MD, Sarayuth Dumrongwongsiri MD, FRCST, Kidakorn Kiranantawat MD, FRCST

Division of Plastic and Maxillofacial Surgery, Department of Surgery, Faculty of Medicine, Ramathibodi Hospital, Mahidol University

Background: Omental lymph node transfer become promising in lymphedema treatment at our center. The anatomy and number of lymph nodes are still unclear from previous studies. For deeper understanding, our study aims to define anatomic location and number of lymph nodes along right gastroepiploic artery.

Materials and Methods: Thirty omentums were harvested from 30 fresh cadavers. Each specimen composes of entire greater curve of stomach and greater omentum including gastroepiploic vessel. Number, size and location of lymph nodes were recorded in two steps. First, lymph nodes founded by direct vision, described as “macroscopic lymph nodes”. Then, omentum was dissected under microscope to further identify “microscopic lymph nodes”. Random samples of lymph nodes were confirmed histologically. Location mapping was done along X- and Y- axes, landmarked by gastric pylorus.

Results: Lymph nodes were found in 26 out of 30 omentums (87%). Despite microscopic dissection, lymph nodes could not be identified in other 4 omentums. Macroscopic lymph nodes were directly identified in 19/26 omentums (73%). The mean size of macroscopic lymph nodes was significantly larger than microscopic lymph nodes ($p < 0.05$). However, there was significantly a greater number of microscopic lymph nodes founded ($p < 0.05$). Lymph nodes could be found scatteredly along right gastroepiploic vessel and 87.37% of lymph nodes were found within 100 mm from pylorus and 88.2% within 20mm caudally from right gastroepiploic vessel.

Conclusion: Consider from quantity and location of lymph nodes, we suggested omental flap, based on right gastroepiploic vessel, as a reliable donor to treat lymphedema.

TRANSORAL ENDOSCOPIC THYROIDECTOMY VESTIBULAR APPROACH (TOETVA) FOR BENIGN THYROID NODULE: A COMPARISON OF SURGICAL RESULTS WITH OPEN THYROIDECTOMY

Kornwalee Koichusakul, Khwannara Ketwong

Department of Surgery, Chiang Rai Prachanukroh Hospital, Mueng, Chiang Rai 57000, Thailand

Background: Transoral endoscopic thyroidectomy vestibular approach (TOETVA) is a novel alternative technique to perform thyroidectomy which provides excellent cosmetic and surgical outcomes.

Objective: To compare the surgical results with those standard open thyroidectomies in patients with benign thyroid nodule.

Materials and Methods: Between June 2018 to January 2020 all patients' pathological diagnosis with benign thyroid nodule in CRH were reviewed retrospectively. TOETVA and Open thyroidectomy (OT) were performed in 55 cases per each group, respectively. Patient baseline characteristics and surgical results, including postoperative pain, operative time, blood loss, duration of hospital stay and complications, were investigated and compared.

Results: TOETVA and OT was performed on 110 consecutive patients. The baseline characteristics were similar in both groups. The mean postoperative VAS pain score in the first three days was comparable for both groups [4.43 (2.01) vs 3.73 (2.5), $P = 0.126$]. Mean estimate blood loss was not statistically different for both groups [20 (76.19) vs 30 (44.28) ml, $P = 0.302$]. But the median operative time was longer for the TOETVA group compared to the OT group [120 (61.55) vs 60 (33.70) mins, $P = 0.00003$]. Mean length of stay was comparable for both groups [3.7 (0.98) vs 3.43 (1.05) days, $P = 0.072$]. For the postoperative complication, 3 patients (5.45%) in TOETVA and 6 patients (10.91%) in OT has RLN injury. One patient (1.82%) had hypocalcemia in both groups. In TOETVA group, one patient (1.82%) had wound infection and one patient (1.82%) had transient mental nerve injury.

Conclusion: TOETVA is an effective and safe surgical approach for benign thyroid nodule with excellent cosmetic outcome. This technique is a reasonable alternative treatment for patients who demanded to avoid a neck scar.

The surgical outcomes and complication rates were similar to those of OT but TOETVA is associated with longer operative time.

Keywords: TOETVA, Thyroidectomy, Transoral endoscopic thyroidectomy vestibular approach

USE OF ETHANOL LOCK FOR PRIMARY PREVENTION OF CATHETER RELATED BLOOD STREAM INFECTION IN PEDIATRIC SURGICAL PATIENTS: PRELIMINARY REPORT

*Donya Kittinaradon¹, Wannisa Poocharoen¹,
Urarat Ariyawangso², Rangsan Niramis¹*

¹ Department of Surgery, Queen Sirikit National Institute of Child Health, Bangkok, Thailand

² Pharmacy Department (Manufacturing Unit), Queen Sirikit National Institute of Child Health, Bangkok, Thailand

Background: Catheter related blood stream infection (CRBSI) is one of the most serious complication of central venous catheterization which can lead to severe sepsis, catheter loss and death. The ethanol lock is now widely used as a second line therapy and secondary prevention of CRBSI especially in patients with intestinal failure.

Objective: This study's objective is to evaluate the effectiveness of ethanol lock as the primary prevention of CRBSI in pediatric surgical patients.

Materials and Methods: This prospective cohort study with period time 1,000 catheter's days uses ethanol lock in all pediatric surgical patients with central venous catheter admitted from February 2020 to January 2021. The ethanol lock was done by indwelling the central venous catheter with 70% ethanol for at least 4 hours per day then the ethanol was aspirated from the catheter before routine using of the catheter. Data collection of demographics, catheter days, complication of central venous catheter and ethanol lock were collected. Statistical analysis was done using SPSS statistics calculator program.

Results: All eight patients that enrolled the study had intestinal failure which required a long term central venous catheter. Preliminary results showed no CRBSI in all patients. After using the ethanol lock for 848 catheter days the incidence rate of CRBSI was 0 per 1,000 catheter days. Our CRBSI rates have declined from 4.79 per 1,000 catheter days in 2019 to 0 per 1,000 catheter days after using ethanol lock. One patient had central line removal due to mechanical breakage of the line while returning home.

Conclusions: Ethanol lock can prevent CRBSI effectively in pediatric surgical patients.

Keywords: Ethanol lock, Catheter related blood stream infection, Central venous catheter

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