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## ORIGINAL ARTICLES



## REVIEW ARTICLE



## ABSTRACTS



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*Original Article*

# *Traumatic Subarachnoid Hemorrhage Lesion Progression on Computed Tomography and Neurological Outcomes*


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*Abstract*

***Objective:*** **The study aimed to investigate the neurological outcomes among traumatic brain injury patients with traumatic subarachnoid hemorrhage (tSAH) and the prognostic factors of intracranial lesion progression on admission- and subsequent-CT scans.**

***Materials and Methods:*** **The study included moderate to severe traumatic brain injury patients who, had tSAH on admission and a CT scan between: January 2009 to December 2011. All patients, included in the study, had a subsequent CT scan within 48 hours after their initial scan. The outcomes were evaluated with Extended Glasgow Outcome Scale (GOSE) at 6 months after injury.**

***Results:*** **468 patients with moderate to severe traumatic brain injuries were reviewed. 147 patients (31.4%) had tSAH on admission along with a CT scan. Among this group, 38 patients (27.3%) had CT lesion progression. The 6-month mortality rate was 16.5%. Multivariate analysis, factors independently related to unfavorable outcome were age (adjusted OR 1.05, 95% CI 1.02-1.07), the Glasgow Coma Scale score (GCS) (adjusted OR 3.47, 95% CI 1.42-9.99) and lesion progression (adjusted OR 9.15, 95% CI 3.78-27.08)**

***Conclusion:*** **The outcome of patients with tSAH at admission is related to age, admission GCS and significant CT progression.**



***Keywords:*** **Traumatic subarachnoid hemorrhage, Lesion progression, Outcome**



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## Introduction

Traumatic brain injury (TBI) is the leading cause of death in young adults and has high magnitude to economic loss especially in low to middle income countries[1,2]. Traumatic subarachnoid hemorrhage (tSAH) is a common lesion that found in moderate to severe traumatic brain injured patients up to 60% in some literatures[3]. This lesion had been clarified as the poor prognostic indicator for a long time[4,5]. Unfortunately, few studies have focused on the patterns or amount of tSAH, the associated lesions on CT scan, and progression of lesion as the independent factors for poor neurological outcome[3,6-9]. But previous reports classified the same characteristics between tSAH and aneurysmal subarachnoid hemorrhage for outcome studies[10]. The patterns of traumatic and aneurysmal subarachnoid hemorrhage are different such as distributions, clearance of blood and time to developed vasospasm[11,12]. In our knowledge, the outcome study of tSAH thickness and subsequent CT scan finding are not found

The aim of this study was to find out relating factors with neurological outcome at 6 months post injury in tSAH patientsand the prognostic factors of intracranial lesion progression.

## Material and Medthod

### *Patients*

The present study retrieved the data of 468 moderate to severe TBI patients who admitted to Songklanagarind hospital after injury between January 1, 2009, and December 31, 2011. The study protocol was approved by the ethics committee at faculty of medicine, Prince of Songkla university (EC number: 56-011-10-4-3). From the hospital database, one hundred and forty-seven patients (31.4%) had a diagnosis of tSAH on an admission CT scan. The exclusion criteria were penetrating head injury, patients needing cardiopulmonary resuscitation and brain death at the emergency department. Patients who did not perform subsequent CT scan within 48 hours after admission were not included. Our study excluded data for outcome study from 8 patients that loss follows up at 6 months.

### *CT evaluation*

All patients underwent an initial CT scan within 8 hours after injury and a subsequent CT scan within 48 hours after the initial CT scan. All CT scans were reviewed retrospectively in all moderates to severe traumatic brain injured patients by the first author (AK) which questionable CT findings would be confirmed by certified neuroradiologists.

The amount of tSAH on the CT scan was measured in axial view and recorded the maximum thickness in millimeter. Topographical location of subarachnoid blood on the CT scan was determined and recorded. The associated lesion (or pathology) that related to traumatic brain injury was evaluated such as cerebral contusion, subdural hematoma, epidural hematoma, intraventricular hemorrhage and skull fracture.

Time interval between injury and the initial CT scan was estimated. All subsequent CT scan that performed within 48 hours was studied and used its data from the worse CT scan in case of multiple for subsequent CT scans.

Lesion progression was defined as subsequent CT scan finding change to worsening Marshall's classification[13] or need any surgical intervention depended on CT scan finding.

### *Outcome*

The authors measured global neurological outcome with the Extended Glasgow Outcome Scale at 6 months after injury by chart review and telephone[14]. The outcome was reported in dichotomous fashion that patients in good recovery and moderate disability (upper and lower level) were grouped in "favorable outcome" and others were "unfavorable outcome".

### *Statistical analysis*

Data were analyzed by program R for Mac Os X, version 2.15.1. Results are presented as percentages for categorical data and means with standard deviations for continuous data. Univariate statistical analyses were performed using Pearson chi-square test and Fisher exact test for categorical data and the Mann-Whitney U-test for continuous data. Multiple logistic regressions were performed for Multivariate statistical analyses and reported as adjusted odds ratios and 95% confidence intervals. Statistical significance was $p$-value < 0.05.

## Results

### *Patient's characteristics*

The present resultsrecruited 139 patients with

**Table 1** Patients characteristic associated 6-months neurological outcome

| Characteristics | All patients (N=139) | GOSE at 6 months | | Adjusted OR | 95% CI. |
|---|---|---|---|---|---|
| | | Favorable (N=84) | Unfavorable (N=55) | | |
| **Sex** | | | | | |
| • Male | 104 (74.8) | 65 (77.4) | 39 (70.9) | 1 | |
| • Female | 35 (25.2) | 19 (22.6) | 16 (29.1) | 1.40 | 0.64-3.05 |
| **Age, years** | 139 | 35.8 ± 13.4 | 43.3 ± 19.6 | 1.03 | 1.01-1.05 |
| **GCS** | | | | | |
| 3-8 | 94 (67.6) | 49 (58.3) | 45 (81.8) | 3.11 | 1.44-7.54 |
| 9-12 | 45 (32.4) | 35 (41.7) | 10 (18.2) | 1 | |
| **ISS** | | | | | |
| 1-15 | 33 (23.7) | 28 (33.3) | 5 (9.1) | 1 | |
| > 15 | 106 (76.3) | 56 (66.7) | 50 (91.0) | 2.09 | 1.05-4.27 |
| **Pupil unreactive On admission** | 13 (9.4) | 2 (2.4) | 11 (20.8) | 8.82 | 2.45-79.60 |
| **Hypoxemia, PaO2 < 80 mmHg** | 11 (7.9) | 6 (7.1) | 5 (9.1) | 1.32 | 0.36-4.54 |
| **Hypotension SBP < 100 mmHg** | 24 (17.3) | 8 (9.5) | 16 (29.1) | 3.76 | 1.54-10.37 |
| **Hypothermia Temp < 36 °C** | 11 (7.9) | 2 (2.38) | 9 (16.4) | 6.74 | 1.81-54.09 |

GOSE, extended-Glasgow outcome scale; GCS, Glasgow coma score; ISS, injury severity score.

tSAH who completed follow up at 6 months after injury. The mean age of the patients was 38 years (range, 15 - 88 years) and 104 patients (74.8%) were male. The most common injury mechanism was motorcycle accident. Ninety-four patients (67.6%) had severe traumatic brain injuries (GCS ≤ 8) and 76.3% had Injuries Severity Score (ISS) more than 15. The ISS was evaluated after resuscitation. (Table 1)

### *Admission CT scans, lesion progression and operative management*

The mean time from injury to initial CT scan was 95.2 ± 82.8 minutes and mean time from initial CT scan to worse subsequent CT scan was 656.3 ± 428 minutes. Only 14 patients (10.1%) had isolated subarachnoid hemorrhage. Cerebral contusion is a most associated lesion that found in 90 patients (61.2%).

Distribution of tSAH was diffused and usually found in one convexity (68 patients, 48.9%) and both convexity (55 patients, 39.6%).

Subsequent CT scan revealed cerebral ischemia in 27 patients (19.4%). Progressive brain lesion caused to change Marshall's classification or operate were 38 patients (27.3%).

Sixty patients (43.2%) had operated immediately after admission and 22 patients (15.8%) after subsequent CT scan. The majority of operative procedures were decompressive craniectomy in 45 patients.

### *Clinical outcome and prognostic factors*

After injury for 6 months, we used GOSE for evaluated patient's outcome. Result were 23 (16.5%) died and 84 patients (60.5%) had favorable outcomes that all of isolated tSAH patients has included. Prognostic factors are presented in Table 1-3.

On univariate analysis, the 6-month neurological outcome was independently associated with patients who had older age, severe traumatic brain injury, severe ISS, unreactive pupils, present of hypoxemia (PaO2 < 80 mmHg), hypothermia (body temperature < 36.0 ˚C), associated with CT scan shown basal cistern obliteration, maximum thickness of tSAH > 7 mm., intraventricular hemorrhage, cerebral infarction and significant lesion progression on subsequent CT scan.

After controlling for other factors and used multinomial logistic regression analysis, neurological outcome was independently with age (adjusted OR 1.05, 95% CI 1.02-1.07), severe traumatic brain injury (adjusted OR 3.47, 95% CI 1.42 - 9.99) and lesion progression (adjusted OR 9.15, 95% CI 3.78 - 27.08) although tSAH distribution and maximum thickness were not associated.

**Table 2** Admission CT scan finding associated 6-months neurological outcome

| Admission CT finding | All patients (N=139) | GOSE at 6 months | | Adjusted OR | 95% CI. |
|---|---|---|---|---|---|
| | | Favorable (N=84) | Unfavorable (N=55) | | |
| **Marshall classification** | | | | | |
| • DI II | 61 (43.9) | 46 (27.3) | 15 (27.3) | 1 | |
| • DI III | 29 (20.9) | 14 (16.7) | 15 (27.3) | 3.21 | 1.29-8.50 |
| • DI IV | 10 (7.2) | 6 (7.1) | 4 (7.3) | 2.08 | 0.47-8.17 |
| • EML | 32 (23.0) | 15 (17.9) | 17 (31.0) | 3.39 | 1.40-8.77 |
| • NEML | 7 (5.0) | 3 (3.57) | 4 (7.3) | 3.86 | 0.82-22.8 |
| **Basal cistern obliteration** | 72 (51.8) | 36 (42.9) | 36 (65.5) | 2.89 | 1.25-5.18 |
| **Midline deviation ≥ 5 mm** | 29 (20.9) | 15 (17.9) | 14 (25.5) | 1.57 | 0.68-3.60 |
| **Location of tSAH** | | | | | |
| Right convexity | 38 (27.3) | 23 (27.4) | 15 (27.3) | 2.54 | 0.72-13.9 |
| Lt convexity | 30 (21.6) | 21 (25.0) | 9 (16.4) | 1.70 | 0.44-9.53 |
| Both convexity | 55 (39.6) | 27 (32.1) | 28 (50.9) | 4.00 | 1.20-21.2 |
| Right Sylvian | 14 (10.1) | 10 (11.9) | 4 (7.3) | 0.71 | 0.17-2.21 |
| Left Sylvian | 16 (11.5) | 10 (11.9) | 6 (10.9) | 1.02 | 0.31-2.94 |
| Both Sylvian | 24 (17.3) | 11 (13.1) | 13 (23.6) | 1.93 | 0.78-4.97 |
| Interhemispheric | 38 (27.3) | 21 (25.0) | 17 (30.9) | 1.34 | 0.63-2.86 |
| Basal cistern | 32 (23.0) | 15 (17.9) | 17 (30.9) | 2.04 | 0.93-4.62 |
| **Maximum thickness of tSAH, mm.** | | | | | |
| 0.1-7 | 12 (8.6) | 6 (7.1) | 6 (10.9) | 1 | |
| > 7 | 25 (18.0) | 7 (8.4) | 18 (32.7) | 2.47 | 2.07-14.8 |
| **IVH** | 22 (15.8) | 9 (10.7) | 13 (23.6) | 2.52 | 1.02-6.74 |
| **Maximum thickness of EDH > 5 mm** | 33 (23.7) | 24 (28.6) | 9 (16.4) | 0.50 | 0.19-1.14 |
| **Maximum thickness of SDH > 5 mm** | 50 (36.0) | 25 (29.8) | 25 (45.5) | 1.95 | 0.97-4.01 |
| **Contusion volume, mL.** | | | | | |
| < 20 | | | | | |
| ≥ 20 | 128 (92.1) | 78 (92.9) | 50 (90.9) | 1 | |
| | 11 (7.9) | 6 (7.1) | 5 (9.1) | 1.32 | 0.36-4.54 |

GOSE, extended-Glasgow outcome scale; DI II, diffuse injury grade II; DI III, diffuse injury grade III; DI IV, diffuse injury grade IV; EML, evacuated mass lesion; NEML, non-evacuated mass lesion; tSAH, traumatic subarachnoid hemorrhage; IVH, intraventricular hemorrhage; EDH, epidural hematoma; SDH, subdural hematoma.

**Table 3** Subsequent CT scan finding associated 6-months neurological outcome

| Subsequent CT finding | All patients (N=139) | GOSE at 6 months | | Adjusted OR | 95% CI. |
|---|---|---|---|---|---|
| | | Favorable (N=84) | Unfavorable (N=55) | | |
| **Cerebral infarction** | 27 (19.4) | 7 (8.3) | 20 (36.4) | 5.97 | 2.45-17.3 |
| **Marshall classification** | | | | | |
| • DI II | 50 (36.0) | 41 (48.8) | 9 (16.4) | 1 | |
| • DI III | 27 (19.4) | 15 (17.9) | 12 (21.8) | 3.52 | 1.28-10.7 |
| • DI IV | 8 (5.8) | 5 (6.0) | 3 (5.5) | 2.78 | 0.49-13.4 |
| • EML | 36 (25.9) | 18 (21.4) | 18 (32.7) | 4.37 | 1.72-12.5 |
| • NEML | 18 (12.9) | 5 (6.0) | 13 (23.6) | 10.7 | 3.34-45.5 |
| Significant lesion progression | 38 (27.3) | 10 (11.9) | 28 (50.9) | 7.35 | 3.29-18.6 |

GOSE, extended-Glasgow outcome scale; DI II, diffuse injury grade II; DI III, diffuse injury grade III; DI IV, diffuse injury grade IV; EML, evacuated mass lesion; NEML, non-evacuated mass lesion.

## Discussion

The elderly and severe traumatic brain injury were found associated with unfavorable neurological outcome in almost traumatic brain injury studies[11,15,16], including patients with traumatic subarachnoid hemorrhage patients in our study. When severe traumatic brain injuries are selected, the rate of unfavorable outcomes was 81.8% and up to 85% in a multicenter study[11]. However, the present study found that all patients with isolated tSAH has favorable outcome. Previous studies have shown that isolated tSAH in all Glasgow Coma Scale score is a relatively less severe finding and not likely to require neurosurgical intervention[17,18].

Despite the consistent evidence of an association between tSAH and worse prognosis, the underlying mechanism is not known. Proposed explanations include the possibilities that tSAH itself initiates or is associated with damaging mechanisms[19] or that SAH is an indicator of greater severity of parenchymal brain damage[20] the same as with other hemorrhagic lesion such as contusion or subdural hematoma. The authors have shown that maximum thickness of tSAH and obliterated basal cistern were independent predictor of unfavorable neurological outcome in univariate analysis. After applied multivariate logistic regression model, both characteristics were not associated with outcomes. In contrast to several previous studies, the prognostic value of the characteristics of tSAH such as maximum thickness or distribution essentially lesion at basal cistern were associated with outcomes[3,9,21,22]. Thus, the prognostic values of thickness of subarachnoid blood and anatomical distribution of blood are still debated.

The relationship between CT progression that change in Marshall classification and/or operative management and unfavorable neurological outcomes was detected in stronger degree than other CT findings. This result was relevance to previous studies[6,11,23].

Thus, evolution of intracranial lesions might be considering in the better prognostic parameter for evaluate TBI patients than admission characteristic alone.

## Study Limitation

This study has many limitations. The management has been varied due to lack of protocol driven that decisions about therapeutic interventions were depended on many neurosurgeons at our institution. Furthermore, the study was limited to a single center where management may vary from other institutes. The authors cannot definitively conclude that there were not any non-traumatic SAH in our study due to did not routinely perform a vascular study such as CT angiography or cerebral angiography on all trauma patients with SAH to rule out an antecedent aneurysmal rupture as an etiology for the traumatic event.

Evaluation of SAH has been mentioned in the literatures, including motion artifacts, related to anemia, imaging qualities and interpreter's experience. In terms of the reliability of SAH measurements have reported a moderate agreement for detected tSAH among study centers ($K = 0.57$)[24] and grading system of traumatic subarachnoid hemorrhage were not well studied[25]. In this study, the authors did not have radiographic assessment of cerebral vasospasm with Doppler ultrasound examinations or xenon computed tomography, therefore, present study are not able to relate our data to arterial blood flow but the cerebral ischemia could be detected in small samples and not related to outcomes.

## Conclusion

Incidence of tSAH was 31.41% in moderate to severe traumatic brain injured patients but isolated tSAH is rare. About 40% of patients had unfavorable outcome that independent to age, admission GCS and significant CT progression.

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## Potential Conflicts of Interest

None

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*บทคัดย่อ* **เลือดออกใต้ชั้นอะแรคนอยด์ภายหลังสมองบาดเจ็บ: ลักษณะรอยโรคที่เลวลงจากภาพถ่ายรังสีคอมพิวเตอร์สมองและผลลัพธ์การรักษาทางระบบประสาท**

**อนุกูล แก้วบริสุทธิ์สกุล, หัชชา ศรีปลั่ง, นครชัย เผื่อนปฐม**

***วัตถุประสงค์:*** เพื่อศึกษาผลการรักษาทางระบบประสาทของผู้ได้รับบาดเจ็บสมองที่พบเลือดออกใต้ชั้นอะแรคนอยด์ และศึกษาปัจจัยที่ใช้พยากรณ์การเปลี่ยนแปลงที่เลวลงของรอยโรคจากการบาดเจ็บสมองเมื่อติดตามด้วยภาพถ่ายรังสีคอมพิวเตอร์สมอง

***วัสดุและวิธีการ:*** ศึกษาข้อมูลย้อนหลังในผู้ได้รับบาดเจ็บสมองระดับปานกลางถึงรุนแรงที่พบเลือดออกใต้ชั้นอะแรคนอยด์ตั้งแต่แรกรับจากภาพถ่ายรังสีคอมพิวเตอร์สมองระหว่างเดือนมกราคม ปี ค.ศ. 2009 ถึงเดือนธันวาคม ปี ค.ศ. 2011 โดยผู้ป่วยทุกรายจะต้องได้รับการติดตามภาพถ่ายรังสีคอมพิวเตอร์สมองภายใน 48 ชั่วโมงหลังเข้ารับการรักษา และประเมินผลการรักษาด้วย Extended Glasgow outcome scale (GOSE) ที่ 6 เดือนหลังได้รับบาดเจ็บ

***ผลการศึกษา:*** ผู้ได้รับบาดเจ็บที่ศีรษะระดับปานกลางถึงรุนแรง 468 ราย ผลการตรวจภาพถ่ายรังสีคอมพิวเตอร์สมองตั้งแต่แรกรับในโรงพยาบาล พบเลือดออกใต้ชั้นอะแรคนอยด์ 147 ราย คิดเป็นร้อยละ 31.4 โดยในกลุ่มนี้มีผู้ป่วย 38 รายที่มีรอยโรคที่เลวลงเมื่อติดตามภาพถ่ายรังสีคอมพิวเตอร์สมอง มีอัตราการเสียชีวิตที่ 6 เดือนหลังการบาดเจ็บร้อยละ 16.5 และปัจจัยที่สัมพันธ์กับผลการรักษาที่ไม่ดี คือ อายุมาก (adjusted odds ratio (OR) = 1.05, 95% confidence interval (CI) 1.02-1.07) ระดับความรู้สึกตัวแรกรับต่ำ (adjusted OR 3.47, 95% CI 1.42-9.99 ) และการตรวจพบรอยโรคที่เลวลง (adjusted OR 9.15, 95% CI 3.78-27.08)

***สรุปผลการศึกษา:*** ปัจจัยที่ส่งผลต่อการรักษาในผู้ป่วยเลือดออกใต้ชั้นอะแรคนอยด์จากอุบัติเหตุคือ อายุ ระดับความรู้สึกตัว และการเปลี่ยนแปลงของรอยโรคในสมอง

***คำสำคัญ:*** เลือดออกใต้ชั้นอะแรคนอยด์จากอุบัติเหตุ, รอยโรคที่เลวลง, ผลการรักษา

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Original Article

# *Outcomes of the Surgical Treatment of Infants with Imperforate Anus and Vestibular Fistula without Primary Colostomy*

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*Abstract*

***Introduction:*** **Female infants with imperforate anus with vestibular fistula can be surgically treated with either one - stage repair without colostomy or conventional multi-stage repair after primarily prospective colostomy. One stage approach is more preferable in the present period.**

***Objective:*** **The aim of this study was to access the outcomes of a single-stage repair without colostomy in female infants with imperforate anus and vestibular fistula.**

***Materials and Methods:*** **Medical records of the patients who were diagnosed imperforate anus with vestibular fistula and treated with a single-stage repair without colostomy during 2012 to 2016 at Queen Sirikit National Institute of Child Health were reviewed. Demographic data, operative procedures and outcomes of treatment were evaluated.**

***Results:*** **During the study period, 34 female infants with imperforate anus and vestibular fistula underwent a single-stage repair without protective colostomy at our institute. They were classified as anovestibular fistula (AVF) in 15 cases (44.1%) and rectovestibular fistula (RVF) in 19 cases (55.9%). Most of the patients were term and normal birthweight infants. Cardiovascular defects were the most common associated anomalies. Infants with AVF were surgically treated by cut-back anoplasty (5 cases), anal transfer (4 cases) and anterior sagittal anorectoplasty or ASARP (6 cases). Infants with RVF underwent only anal transfer (5 cases) and ASARP (14 cases). Wound infection and wound dehiscence were the common postoperative complications which were noted in approximately 15% and 25%, respectively. Anorectal retraction and recurrent fistula occurred in one case, each. Both cases required redo-operation for correction several weeks later without protective colostomy. One-third of the patients had constipation with more often in RVF than AVF. Constipation was managed by toilet training, laxative and occasional enema. There was no mortality in all of the patients.**

***Conclusion:*** **Female infants with imperforate anus and vestibular fistula could be safety treated by a single-stage repair without protective colostomy. From the present study, even major complications occurred and required redo-operation, the patients could be successfully corrected without diverted colostomy.**

***Keywords:*** **Imperforate anus, Vestibular fistula, Single-stage repair, Without protective colostomy, Outcome**

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## Introduction

Imperforate anus with vestibular fistula (IA with VF) is the most common form of anorectal malformations (ARMs) in female infants. The diagnosis is based on physical examination. In this condition, the fistula lies between the vagina and the fourchette, and the opening is surrounded by vestibular mucosa. According to International[2] and Wingspread's Classification[3], vestibular fistula (VF) can be classified into rectovestibular fistula (RVF) which is an intermediate defect (Figure 1) and anovestibular fistula (AVF) as a low defect (Figure 2). Historically, several operative techniques were described for VF repair including cut-back anoplasty, perineal anal transfer or transplantation, Y-V and X-Z plasty, limited posterior sagittal anorectoplasty (PSARP) and anterior sagittal anorectoplasty (ASARP)[4-7].

IA with VF can be repaired with or without a protective colostomy. Traditionally, most surgeons usually advocated a protective colostomy especially in infants with RVF, in order to prevent major postoperative complications such as surgical wound infection, wound dehiscence, anorectal retraction and recurrent fistula. Recently, more pediatric surgeons prefer to treat VF with a single-stage repair without protective colostomy both imperforate anus with AVF and RVF.

The aim of this study was to evaluate the outcomes of a single-stage repair without protective colostomy in the patients with IA and VF treated at our institute.

**Figure 1** Imperforate anus with rectovestibular fistula (intermediate type based on International and Wingspread Classification)

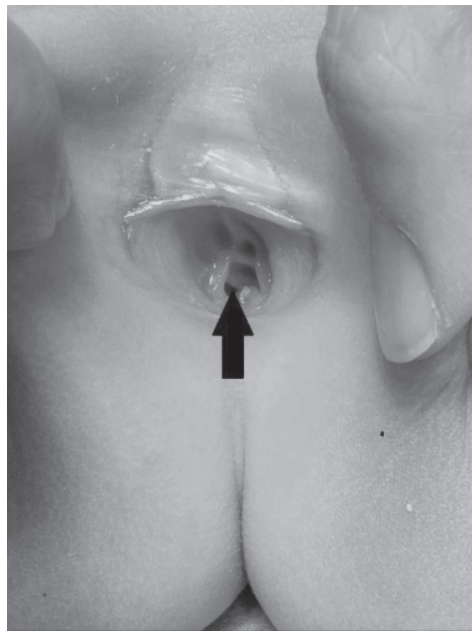

**Figure 2** Imperforate anus with anovestibular fistula (low type based on International and Wingspread Classification

## Materials and Methods

A retrospective study was conducted at Department of Surgery, Queen Sirikit National Institute of Child Health (QSNICH) after the proposal (Document No.61-032) had been approved by the Ethic Committees of the institute. Medical recorded of all the patients who were diagnosed IA with VF and underwent primary repair without protective colostomy at QSNCIH from January 2012 to December 2016, were reviewed. The patients who had been treated from the other hospitals or transferred for redo-surgery were excluded from the study. Demographic data, associated anomalies, type of operative procedures and results of the treatment were evaluated. Decisions for operative repair with or without protective colostomy depended on the surgeon's preference.

Data were analyzed using SPSS version 20 (IBMs® SPSS statistic). Correlations between categorical variables were evaluated by Chi-square test. A *p*-value of less than 0.05 was considered significant.

## Results

During the study period, 102 female infants were diagnosed IA with VF. Only 34 cases (33.3%) were treated by a single-stage repair without protective

colostomy. According to International[2] and Wingspread's Classification[3], anovestibular fistula (AVF) : rectovestibular fistula (RVF) was noted in 15 : 19 cases (44.17% : 55.9%). Demographic data between both groups including gestational age, birth weight and associated anomalies were not different (Table 1). Most of infants with AVF underwent surgical correction in the first week of life, while those with RVF had lately repaired because RVF required fistular dilatation at home before surgery.

Infants with AVF could be treated by ASARP (6 cases), anal transfer (4 cases) and cut-back anoplasty (5 cases). Surgeons preferred correction of RVF by ASARP in 14 cases and anal transfer in 5 cases (Table 2). Cut-back anoplasty was not performed in our patients with RVF.

Eary postoperative complications were not different between AVF and RVF (Table 3). Common complications were surgical wound infection and wound dehiscence which were managed with local wound care, except wound dehiscence of 2 cases with RVF required wound re-suturing. Anorectal retraction after wound infection and dehiscence occurred in one case with RVF after ASARP and required redo-ASARP several weeks later.

Length of stay ranged from 7-31 days (average 13.3 days) in AVF and 6-45 days (average 15.3 days) in RVF. The patients were followed-up at the out-patient department 2 weeks after discharge from the hospital. Surgeons demonstrated anal dilatation with Hegar's dilator to the parents and advocated them to do with their children everyday at least 3 months. Follow-up time of all the patients ranged from 1 to 6.4 years (mean 2.64 years). Late complications included constipation and anorectal stricture occurring in both AVF and RVF. Rectal mucosal prolapse and recurrent fistula after wound dehiscence occurred only RVF, one case each (Table 3). Excision of prolapsed rectal mucosa and repair of recurrent RVF were done several weeks later. Anorectal stricture were treated by anorectal dilatation with Hegar'sdilator everyday until complete recovery. Patients with constipation were received laxative and occasional enema. The parents were encouraged to train toilet training their children at home for improvement of fecal incontinence and constipation. There was no mortality in all of our

**Table 1** Demographic data of 34 female infants with vestibular fistula

| Patients' data | Total No. | Anovestibular fistula Cases (%) | Rectovestibular fistula Cases (%) | *P* = value |
|---|---|---|---|---|
| Imperforate anus with vestibular fistula | 34 | 15 (44.1%) | 19 (55.9%) | 0.304 |
| • Gestational age (weeks) range (average) | 33-40 (37.2) | 36-39 (37.2) | 34-40 (36.9) | 0.206 |
| • Birth weight (kg) range (average) | 1.6-3.2 (2.5) | 1.6-3.2 (2.5) | 1.6-3.1(2.5) | 0.365 |
| • Age at operation range (average) | 1 day-6.5 months (59.8 days) | 1 day-5 months (37.8 days) | 6 days-6.5 months (78.1 days) | 0.048* |
| • Associated anomalies cardiovascular (PDA,ASD) | 7 (20.5) | 4 (26.7) | 3 (15.8) | 0.436 |
| Vertebral | 2 (5.8) | 0 | 2 (10.6) | 0.195 |
| Genitourinary | 1 (2.9) | 0 | 1 (5.3) | 0.863 |
| Other | 2 (5.8) | 1 (6.7) | 1 (5.3) | 0.253 |

**Table 2** Operative techniques for a single-stage repair without colostomy

| Operative techniques | Total N = 34 cases (%) | Anovestibular fistula (N = 15) cases (%) | Rectovestibular fistula (N = 19) cases (%) | *P* = value |
|---|---|---|---|---|
| Cut-back anoplasty | 5 (14.7) | 5 (33.3) | 0 | 0.006* |
| Anal transfer | 9 (26.5) | 4 (29.7) | 5 (26.3) | 0.982 |
| Anterior sagittal anorectoplasty | 20 (58.8) | 6 (40.0) | 14 (73.7) | 0.048* |

**Table 3** Postoperative complications

| Complications | Total N = 34 cases (%) | Anovestibular fistula (N = 15) cases (%) | Rectovestibular fistula (N = 19) cases (%) | *P* = value |
|---|---|---|---|---|
| **Early** | | | | |
| • Wound infection | 5 (14.7) | 2 (13.3) | 3 (15.8) | 0.841 |
| • Wound dehiscence | 9 (26.6) | 4 (26.7) | 5 (26.3) | 0.982 |
| • Anorectal retraction | 1 (2.9) | 0 | 1 (5.3) | 0.694 |
| **Late** | | | | |
| • Recurrent fistula | 1 (2.9) | 0 | 1 (5.3) | 0.410 |
| • Rectal mucosal prolapse | 1 (2.9) | 0 | 1 (5.3) | 0.367 |
| • Anorectal stricture | 2 (5.8) | 1 (6.7) | 1 (5.3) | 0.253 |
| • Constipation | 10 (29.3) | 3 (20.0) | 7 (36.8) | 0.285 |

patients.

## Discussion

ARMs in female neonates encompass spectrum of defects ranging from imperforate anal membrane to persistent cloaca. Imperforate anus with vestibular fistula (including AVF and RVF is the most common defect in female patients[1-3].

In the past, AVF was accepted to primary surgical correction without protective colostomy and RVF should be performed protective colostomy before definitive repair[2,3]. Nowadays, a single-stage repair without primarily colostomy for the treatment of both AVF and RVF have been advocated by many reports[5,8-12]. This approach does not only reduce the colostomy related complications, but also reduce the cost of treatment and hospital stay with comparable results[8-11].

Nevertheless, many reports provoked the importance of colostomy[6,13-16]. Without protective colostomy, wound infection and wound dehiscence are the perceived complications leading to severe stricture with fibrosis or even recurrent fistula. Furthermore, if these complications occur, a redo-surgery is known to have poorer functional outcome and the patient may have lost the best opportunity for the optimal functional results[14]. Despite the results are still debating and most authors agree that the surgeon experience is a critical factor in improving the results of a single-stage repair. Therefore, this approach should be recommended for the experienced surgeon[6,13,15].

The single-stage repair of vestibular fistula, both AVF and RVF, has been performed at our institute by some attending staffs over 10 years. Preoperative preparation, operative technique and postoperative care were individualized, depending on the surgeon's experience.

In the present study, most patients were term neonates with normal birthweight. Associated anomalies were noted in one-third of cases and cardiovascular defect was the most common anomaly, similar to the other reports[17,18].

Operative techniques for correction were chosen based on the type of fistulas and surgeon's prefer. ASARP, which was modified from PSARP by Okada[7], is the most popular method for repair of vestibular fistula, both AVF and RVF[7,13,14]. Anal transfer, which preserves the anterior part of anal sphincter, was the second frequently used in our institute. A cut-back anoplasty should not be performed in intermediate and high anomalies, such as RVF. Therefore, our patients with RVF underwent ASARP and anal transfer. A cut-back anoplasty did not used in our cases with RVF.

The most common early postoperative complications were wound infection and wound dehiscence. Wound infection occurred in our patients both AVF anal RVF with no statistic significance. The incidence of postoperative wound infection was reported ranging from 0% to 12.1%[16,18,19]. Wound dehiscence often developed after wound infection, but some cases might spontaneously occur without an evidence of infection. The incidences of wound dehiscence were reported in a wide range from 0% to

39.4%[16,18-21]. Most of wound infection and dehiscence could successfully recover by conservative treatment. Our 2 cases required re-suturing for treatment of wound dehiscence. Anorectal retraction occurred in a few cases and caused by inadequate rectal mobilization, anastomosis under tension and wound dehiscence[6]. A redo-ASARP should be done after the wound was subside from infection and inflammation several weeks. Recurrent fistula did not occur in some reports[12,16,20]. One case with RVF in this study developed a recurrent fistula with suspicion of postoperative wound infection and wound dehiscence. Repair of the recurrent fistula and redo-ASARP for management of anorectal retraction were successfully done without diverted colostomy.

Constipation was the most common late constipation in many reports[4,8,225-24]. Peña[6] reported as high as 55% of cases. The present study showed that constipation occurred in approximately 30% of all vestibular fistula and more often in RVF than AVF. Most of the patients required laxative, enema and the important toilet training from their parents.

## Conclusion

By considering the disadvantages of colostomy, repair of vestibular fistula without colostomy should be a preferred and reliable approach. The outcomes were promising and none of the patients in this study required colostomy, even in the cases with having major complications.

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*บทคัดย่อ* **ผลการรักษาเด็กที่ไม่มีทวารหนักแต่กำเนิดชนิดของ Vestibular Fistula โดยไม่ทำ Colostomy**

**สุจิตรา เก็บทอง, พบ, อัจฉริยา ทองสิน, พบ, วราภรณ์ มหธราดล, พบ.**
*กลุ่มงานศัลยศาสตร์ สถาบันสุขภาพเด็กแห่งชาติมหาราชินี กรุงเทพฯ*

***ความเป็นมา:*** ทารกเพศหญิงที่ไม่มีรูทวารหนักและมีรูเปิดอยู่หน้าต่อช่องคลอด สามารถที่จะรักษาโดยการผ่าตัด ทั้งชนิดผ่าตัดครั้งเดียวไม่มีการเปิดทวารเทียมหน้าท้องดักหน้าไว้ก่อน หรือจะผ่าตัดหลายครั้งเป็นขั้นตอนโดยมีการเปิดทวารเทียมป้องกันไว้ก่อน แบบที่เคยทำกันมาในอดีตก็ทำได้ การผ่าตัดให้สำเร็จในครั้งเดียวได้รับความนิยมมากขึ้นในปัจจุบันนี้

***วัตถุประสงค์:*** การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อประเมินผลลัพธ์ของการรักษาทารกที่ไม่มีรูทวารหนักแต่กำเนิดและมีรูเปิดหน้าต่อช่องคลอด ที่รักษาโดยการผ่าตัดครั้งเดียวโดยไม่ได้เปิดทวารเทียมที่หน้าท้อง ระหว่างปี พ.ศ. 2555 ถึง พ.ศ. 2559 ที่สถาบันสุขภาพเด็กแห่งชาติมหาราชินี ข้อมูลทั่วไป ชนิดหรือวิธีการผ่าตัด และผลลัพธ์ของการผ่าตัด ถูกนำมาตรวจสอบ

***ผลการศึกษา:*** ในระยะที่ทำการศึกษา ทารกเพศหญิง 34 ราย ที่ไม่มีรูเปิดของทวารหนัก และมีรูเปิดที่หน้าช่องคลอดได้รับการรักษาชนิดผ่าตัดครั้งเดียวโดยไม่เปิดทวารเทียมที่หน้าท้อง ที่สถาบันของเรา รูเปิดที่อยู่หน้าต่อช่องคลอด (vestibular fistula -VF) ถูกจัดออกเป็น 2 ชนิด คือ รูเปิดที่ชี้ไปทางทวารหนักด้านล่าง (anovestibular fistula - AVF) จำนวน 15 ราย (ร้อยละ 44.1) และ รูเปิดที่ชี้ขึ้นไปหาไส้ตรงด้านบน (rectovestibular fistula- RVF) จำนวน 19 ราย (ร้อยละ 55.9) ผู้ป่วยส่วนใหญ่คลอดครบกำหนดและมีน้ำหนักแรกเกิดปกติ ความผิดปกติของหัวใจและหลอดเลือด เป็นความพิการแต่กำเนิดที่พบบ่อยที่สุด ทารกที่มี AVF ทำการผ่าตัด cut-back anoplasty (5 ราย) anal transfer (4 ราย) และ anterior sagittal anorectoplasty หรือ ASARP (6 ราย) ทารกที่มี RVF ทำผ่าตัดโดยวิธี anal transfer (5 ราย) และ ASARP (14 ราย) แผลติดเชื้อและแผลผ่าตัดแยกเป็นภาวะแทรกซ้อนที่พบได้บ่อยที่สุดหลังการผ่าตัด พบประมาณร้อยละ 15 และร้อยละ 25 ตามลำดับ การหดกลับของทวารที่สร้างใหม่และการเกิดซ้ำของรูเปิดหน้าต่อช่องคลอดพบได้อย่างละ 1 ราย ซึ่งภาวะแทรกซ้อนทั้งสองชนิดนี้ จำเป็นต้องมีการผ่าตัดแก้ไขซ้ำในหลายสัปดาห์ต่อมา แต่ก็ไม่ได้เปิดทวารเทียมที่หน้าท้องป้องกันแต่อย่างใด หนึ่งในสามของผู้ป่วยทั้งหมด มีอาการท้องผูก ซึ่งเกิดกับผู้ป่วยที่มี RVF บ่อยกว่า AVF อาการท้องผูกรักษาโดยการสอนเรื่องฝึกการขับถ่ายอุจจาระ รับประทานยาระบาย และสวนอุจจาระในบางครั้ง ไม่มีการเสียชีวิตในผู้ป่วยทั้งหมดที่ศึกษาครั้งนี้

***สรุปผลการศึกษา:*** ทารกเพศหญิงที่ไม่มีรูเปิดของทวารหนัก และมีรูเปิดอยู่หน้าต่อช่องคลอด สามารถรักษาได้อย่างปลอดภัยด้วยวิธีการผ่าตัดครั้งเดียว โดยไม่ได้เปิดทวารเทียมที่หน้าท้อง เพื่อป้องกันไว้ก่อน จากการศึกษาครั้งนี้แม้ว่าจะมีภาวะแทรกซ้อนที่สำคัญ จำเป็นต้องผ่าตัดแก้ไขซ้ำ ผู้ป่วยก็สามารถรักษาโดยการผ่าตัดแก้ไขใหม่ได้สำเร็จและไม่ต้องเปิดทวารเทียมที่หน้าท้อง

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Original Article

# *Evaluation of Initial Results of Laparoscopic Inguinal Hernia Repair in Children at Vietduc University Hospital*

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*Abstract*

***Objective:*** **To evaluate the early outcomes of totally intra-peritoneal laparoscopic inguinal hernia repair in children by stitching herniated sac in the deep inguinal orifice at VietDuc university hospital.**

***Materials and Methods:*** **Prospective and retrospective study, 153 patients over 2 years old that were diagnosed with inguinal hernia based on clinical symptoms and ultrasound and treated with laparoscopic technique that use 3 trocars (1 trocar 5mm, 2 trocars 3mm) to stitch hernia sac in the deep inguinal orifice at VietDuc university hospital from January 2017 to June 2018.**

***Results:*** **In 153 patients: 10 bilateral hernias (6.5%), 31 unilateral hernias were diagnosed with contralateral hernia by laparoscopic (20.3%), 112 unilateral hernias (73.2%). The mean surgical time was 25.2 minutes (30.1 minutes with bilateral hernia, 22.9 minutes with unilateral hernia). Hospital stay duration 1.6 day. No case of surgical catastrophe. Post-operation: 2 patients were bleeding in position of the umbilical trocar and 3 patients were mild swelling of the groin, scrotum. Post-operation follow-up 3 months: no recurrence, no testicular atrophy.**

***Conclusion:*** **Laparoscopy that use trocar 3mm to treat inguinal hernia in children is safe, feasible, effective methods. The opportunity to diagnose a bilateral hernia when non-diagnosed before surgery, or in case of recurrence after an inguinal approach, are the main advantages for laparoscopy.**

***Keywords:*** **Pediatric inguinal hernia, laparoscopic inguinal hernia**

## Introduction

Pediatric inguinal hernia is one of the most common diseases encountered by pediatric surgeons. Surgical management of pediatric inguinal hernia (PIH) including exposing the herniated materials and tying off the processus vaginalis at deep inguinal ring level. To do this, there are 2 surgical methods: open surgery and laparoscopic surgery. In the recent 20 years, laparoscopic surgery has become common. Many studies have reported several advantages of the laparoscopic procedure over the open one, i.e. the ability to assess the contralateral deep inguinal ring, and the ability to close the unclosed contralateral deep inguinal ring in the same phase[1,2]. This helps reducing

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the rate of recurrence after open repair of inguinal hernia. In Vietnam, laparoscopic repair of PIH has been performed at several pediatric surgical centers, but there has not been any study yet to assess the result of this method. Thus, we report our experience in this topic using the preliminary assessment of the laparoscopic repair of pediatric inguinal hernia.

## Materails and Methods

### *Subjects*

This study was performed at Department of Pediatric and Neonatal Surgery, VietDuc University Hospital, from January 2017 to June 2018. In this period, 153 children were diagnosed with PIH and were treated with laparoscopic repair. Most patients were discharged 1 day after the procedure. We then set up appointment for reassessment after 3 months.

### *Surgery technique*

The technique of the repair is as follows: the laparoscopic repair is done under general anesthesia. 3 trocars are inserted: a 5mm one is inserted through the umbilicus, two 3mm ones are inserted at the left and right subcostal regions. The abdominal cavity is then insufflated with $CO_2$ at a pressure of 6 - 10mmHg.

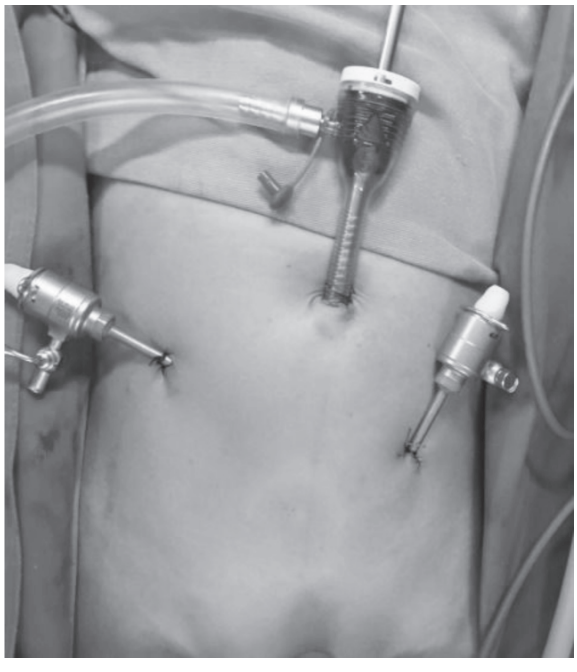

**Figure 1** Placement of trocars

Assess the contralateral deep inguinal ring. Use dissecting clamp to pull the hernia sac into the abdominal cavity, and open the peritoneum at the deep inguinal ring.

In male patients, dissect and free the peritoneum at the deep inguinal ring from the testicular vessels, then cut the hernia sac. In female patients, after pulling the hernia sac (Canal of Nuck) into the abdominal cavity, use monopolar electrocautery for hemostasis, and also cut the hernia sac.

A needle is inserted into the abdominal cavity directly through the skin. A Z-stitch suture is used to tie the peritoneum at the deep inguinal ring intraabdominally. If the contralateral deep inguinal ring is not closed yet, the similar technique is applied to that side.

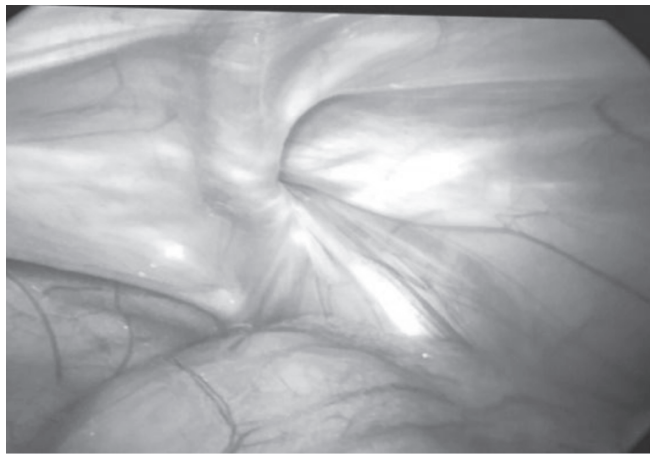

**Figure 2** Right hernia ring

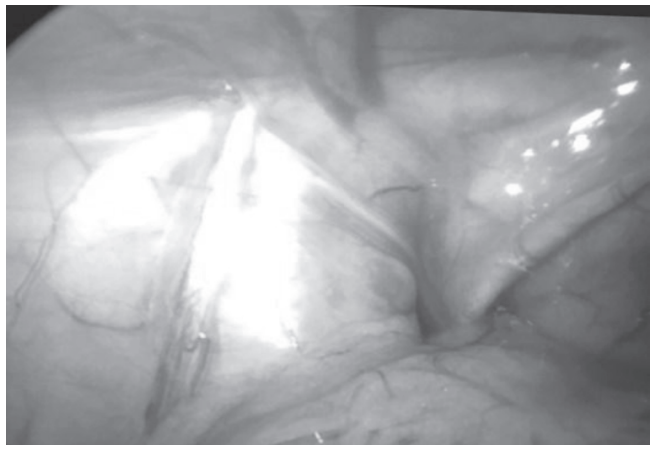

**Figure 3** Closed contralateral deep inguinal ring

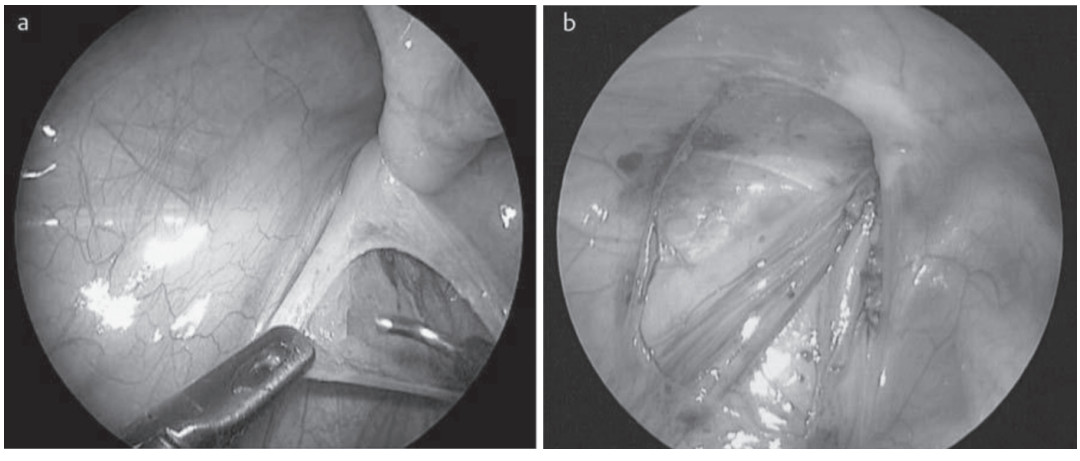


**Figure 4** Dissecting and freeing the peritoneum through laparoscopy

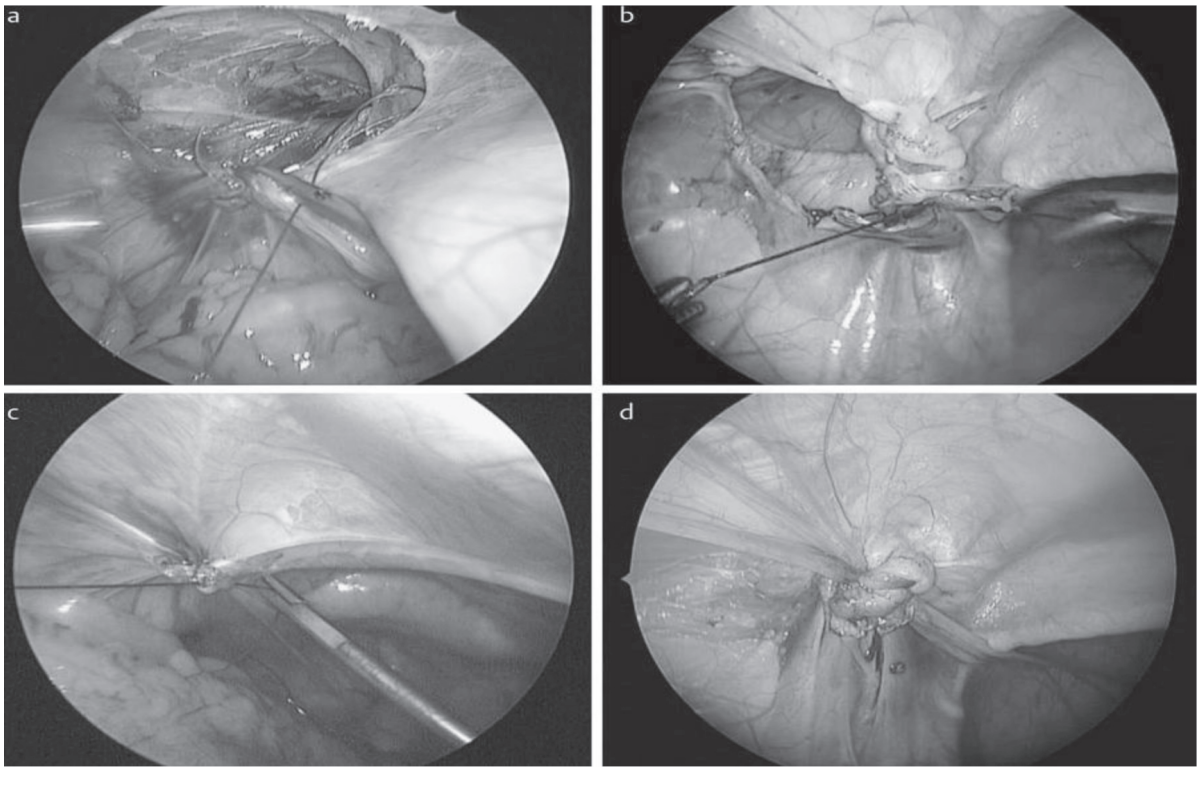


**Figure 5** Stitching the peritoneum through laparoscopy

## Results

153 patients received the repair, including 102 boys (66.7%) and 51 girls (33.3%). 10 patients with bilateral PIH (accounting for 6.5%) were diagnosed pre-operatively, while 31 patients were diagnosed with bilateral PIH during the surgery (accounting for 20.3%) and received the repair in the same phase. 34 patients (73.2%) had unilateral PIH. Their age ranged from 2 to 10 years old, with an average age of 4.8. 100% of the patients were diagnosed with indirect inguinal hernia, and none was diagnosed with direct inguinal hernia or femoral hernia. The average duration of surgery for the unilateral group is 22.9 minutes (24.4 minutes for boys, and 20.3 minutes for girls), and the average duration for the bilateral group and the unilateral group with open contralateral deep inguinal ring is

30.2 minutes (33.1 minutes for boys, and 27.6 minutes for girls). There was no complication during surgery. The normal time for recovery is 1 day, and the average length of hospital stay is 1.6 days. After the operation, 2 patients had bleeding from the umbilical port, and 3 male patients had mild swelling in the scrotum region. Follow-up in 3 month after surgery, no patient had recurrent inguinal hernia, testicular atrophy or persistent infection of surgical site.

## Discussion

### *a. Diagnostic laparoscopy*

Inguinal hernia is one of the most common pediatric diseases, accounting for 1 to 4% of all children who received surgery. In the newborns and young children, the risk of incarcerated inguinal hernia is 31% (usually occurs when the children reach a few month of age), posing danger for their intestines and testicles[3]. Thus, inguinal hernia repair is recommended as soon as possible after the diagnosis. Moreover, the rate of contralateral inguinal hernia after open surgery can be assessed earlier with laparoscopic surgery, and perioperative assessment of the contralateral inguinal ring and the existence of the contralateral processus vaginalis. The rate of open deep inguinal ring in patients with unilateral inguinal hernia was reported from 31% to 48%[4,5]. In our study, this rate is 20.3%.

Apart from the ability to detect the existence of the contralateral processus vaginalis, the laparoscopic approach has more benefit over the traditional open method in correctly assessing the anatomy of the groin region, detecting direct inguinal hernia, femoral hernia or the combination of multiple types of hernia[6,7]. Another advantage of this method is leaving the vas deferens and the testicular vessels intact, especially when the patients had recurrent inguinal hernia after a previous open surgery. In the case of recurrent inguinal hernia, this method helps both in its diagnosis and treatment.

### *b. Laparoscopic treatment*

When assessing the feasibility of laparoscopic surgery in comparison with open surgery, regarding to the operate time, 2 studies have pointed out that the length of surgery for both laparoscopic and open repair is the same[8]. Chan and Tam[9] with single-blind comparison has reported that the duration of the laparoscopic repair is shorter than the open one .

The advantage of laparoscopic surgery is to help the surgeon detect the existence of the contralateral processus vaginalis through assessing the width and depth of the processus vaginalis. Many studies has shown the existence of the contralateral processus vaginalis through laparoscopy[10]. The question is, when to treat the contralateral processus vaginalis. Koivusalo[2] stated that the repair should only be done in the presence of symptoms. However, in the study of Koivusalo, the average age is from 7 months to 15 years old. Sachs[11] argued that the processus vaginalis remained opened in 57% of children from 4 months to 1 year old. According to F. Becmeur[1], in the newborns and the breastfeeding children, the deep and superficial inguinal ring is almost overlapped. Thus, dissecting the deep inguinal ring in this age can easily damage the superficial inguinal ring and other components in the inguinal canal. After 2 years old, when the child can walk easily, the two inguinal rings move apart, it would be clearer to dissect the peritoneum at the neck of the hernia sac. For these reasons, in our study, the existence of the contralateral processus vaginalis account for 20.3%, and we decided to repair immediately.

Nowadays, the laparoscopic repair including intraperitoneal, extraperitoneal and a combination of both approaches. We chose the intraperitoneal approach. Dissecting the peritoneum at the neck of the sac, freeing the peritoneum from the vas deferens and the testicular vessels and closing the peritoneum with non-absorbable stitches. Using non-absorbable stitches is one of the reasons causing post-operative recurrence. Parelka[12] who reported 437 children underwent laparoscopic inguinal hernia repair, argued that one of the reasons causing post-operative recurrence in his 14 patients is because of non-absorbable stitches. Thus, we used only non-absorbable stitches. When dissecting the peritoneum, we prefer dissecting scissor over monopolar electrocautery hook, to avoid thermal damage to the testicular vessels. When cutting the peritoneum, to avoid cutting the vas deferens and the testicular vessels, we lifted the peritoneum at the neck of the sac. By dissecting the peritoneum and closing the peritoneum at deep inguinal ring, the hernia can be fixed successfully without causing damage to components of the inguinal

canal, unlike open surgery.

Moreover, laparoscopic repair allows diagnosing and treating congenital malformations of the reproductive system in those with sex chromosomal abnormalities[10], treating undescended testicles in combination with inguinal hernia[13]. Furthermore, laparoscopy is also very useful to those with recurrent hernia. After an open surgery, scar tissue forms in the inguinal canal, and if another open surgery is performed, the risk of damaging the testicular vessels and the vas deferens is higher. When performing laparoscopic procedure, especially the intraperitoneal one, it is easier to dissect the neck of the sac from the testicular vessels, reducing the risk of damaging these structures.

After 3-month post-operative follow-up, we have not found any case with recurrent inguinal hernia, testicle atrophy or persistent infection of the surgical site. Furthermore, all patients and their families are very satisfied with the result of the repair.

## Conclusion

Laparoscopic repair of pediatric inguinal hernia is a safe, effective and feasible, and it can be easily done in pediatric surgical centers. Intraperitoneal laparoscopic technique can be performed by dissecting the peritoneum and closing the peritoneum at the neck of the hernia sac. The operating duration, the post-operative period and the result of the surgery is the same as the open procedure. However, compared with open surgery, laparoscopic surgery has more advantages in assessing the existence of the contralateral processus vaginalis, deciding whether the contralateral repair can be done in the same phase, making proper anatomical assessment and detecting other congenital malformations of the reproductive system. Furthermore, laparoscopic surgery is more advantageous in diagnosing and repairing recurrent hernia. Long-term follow-up will be needed to accurately determine the rate of recurrent inguinal hernia.

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Review Article

# *Current Surgical Role in The Management of Pediatric Renal Tumors*

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*Abstract* **Pediatric renal tumors (PRT) belong to a group of cancers arising in early human life called the embryonal tumors. Wilms tumor is the predominant pathologic type, followed by rare entities including clear cell sarcoma of the kidney, malignant rhabdoid tumor of the kidney and pediatric renal cell carcinoma. Although there is some controversy regarding the optimal treatment sequence, surgery is usually the definitive treatment and radical nephrectomy remains the standard surgical option for unilateral tumors. Apart from tumor removal, data from lymph node sampling and recording of intraoperative spills are important for surgical staging. Bilateral PRT and complicated situations such as tumors in young infants, tumors with intravenous thrombus and concomitant intraabdominal metastases indicate upfront chemotherapy should be applied first followed by surgery. Nephron-sparing surgery in bilateral PRT is a surgically challenging situation requiring anatomical planning and meticulous care. In general, PRT has a good outcome unless there is metastasis, intraoperative rupture or unfavorable histopathological features at the diagnosis. The five-year overall survival in cases of non-metastatic Wilms tumor has reached 100% in large trial reports. However, outcomes in low-income countries remain poor because of late diagnosis and toxicity from treatment. Good surgical technique potentially reduces operative complications, especially spills. This review focuses on the current surgical role in the treatment of PRC.**

*Keywords:* **Wilms tumor, Renal tumor, Nephrectomy, Nephron-sparing surgery**

## Introduction

Although pediatric renal cancer is an uncommon human malignancy comprising less than 1% of the whole pie of human cancers, it accounts for 6-9% of all childhood cancers[1,2]. The age-standardized incidence rates (ASR) of renal cancers in European countries and America have been reported as 8.8 and 8.29 new cases/million person-years, respectively[1-3]. In Thailand, a study from Thai Pediatric Oncology Group (TPOG) reported an increase in the pediatric renal cancer ASR from 2.5/million person-years during the decade 1990-2000 to 4.0/million person-years during 2001-2010[4]. Nephroblastoma or Wilms' tumor (WT) is the most common pathological diagnosis in this group, accounting for more than 90% of all cases[5]. The tumor's name was derived from Max Wilms, a German surgeon who published a monograph on 'Mixed tumors of the kidney' in 1899[6]. The other differential diagnoses include clear cell sarcoma of the kidney (CCSK), malignant rhabdoid tumor of the kidney (MRTK) and pediatric renal cell carcinoma (PRCC)[7]. While the majority of WT and CCSK tumors are diagnosed before

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5 years of age[8], MRTK and PRCC tumors are more occur in older children[9,10].

The most common presentation of WT is a palpable abdominal mass in an otherwise clinically well infant[5]. Hematuria is found in 30% of cases while other symptoms such as abdominal discomfort, fever, anemia and hypertension are occasionally found[11, 12]. About 10% of WT cases already have metastatic disease, usually hematogenous metastasis to the lungs and liver. Approximately 5-10% of WT cases have associated genetic syndromes, such as WAGR (WT, aniridia, genitourinary anomalies and mental retardation), Denys-Drask syndrome or Beckwith-Wiedemann syndrome[13]. These patients with syndromic predisposition have a higher chance of bilateral diseases and usually present at a younger age[14]. Ultrasound is the first line investigation in evaluating pediatric renal tumors, and is also the most reliable method for evaluating tumor thrombus within the renal vein and inferior vena cava[15,16]. Either computerized tomography (CT) or magnetic resonance imaging (MRI) is usually requested for more information regarding tumor extent, contralateral kidney evaluation and relationship of the primary tumor to surrounding structures. Moreover, CT and MRI give more information about nephrogenic rests, which is predispose towards renal parenchymal pathology. On contrast-enhanced CT, a so-called claw or bird beak sign is a characteristic radiological feature of WT (Figure 1)[15]. Currently, there are no known diagnostic serum markers for any pediatric renal cancers.

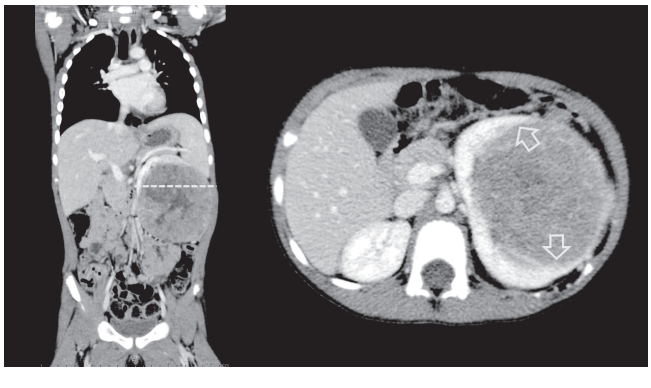


**Figure 1** CT scan showing left-side Wilms tumor in a 4-year-old boy. Yellow arrows depict a bird beak signs which discriminate an intrarenal mass from renal parenchymal compression from an extrarenal lesion.

The current management of WT and other non-WT renal tumors is a multidisciplinary approach, comprising surgery, chemotherapy and external irradiation. The surgical role is either primary nephrectomy or delayed nephrectomy after upfront chemotherapy[16]. An open biopsy is rarely indicated unless upfront chemotherapy is planned and transcutaneous imaging-guided biopsy could not give a conclusive histological diagnosis[10]. The prognosis of WT is generally good, especially in the countries participating in large trials where 5-year survival has been reported at over 80%. Apart from stage and histological subtypes, the particular surgical technique used for a nephrectomy can influence longterm outcomes as relapse and residual disease are 2 main factors associated with poor outcome of WT[11]. CCSK and MRTK are more aggressive tumors and generally have an inferior prognosis compared to WT.

This review focuses on the standard of care in surgery of pediatric renal tumors, especially WT. Other related topics that are crucial in understanding surgical strategies such as tumor biology are also addressed.

## Pathology and Biology of Pediatric Renal Cancer

The typical WT contains 3 histopathological elements: blastemals, stromal and epithelial tubules. Ninety percent of WTs are classified as favorable histology while 10% have anaplasia (unfavorable histology)[17,18]. The latter diagnosis is found mainly in older children which explains the poorer prognosis of WT in the older age group. Multifocal and extrarenal anaplasia is regarded as 'diffuse anaplasia' which has the worst prognosis among WTs. The classic histopathology of CCSK consists of a 'chicken wire' pattern of small blood vessels among nests of ovoid, epithelioid, or spindle cells[19] while MRTK consists of sheets of cells showing nuclear polymorphism and open cesicular nuclei, prominent nucleoli, and scattered hyaline eosinophilic cytoplasm[20]. The standard surgical staging of WT is shown in the Table 1.

WT belongs to a group of pediatric tumors arising in developing embryonal tissue which are called embryonal tumors. Germline mutations of WT1 on chromosome 11q13 result in defective metanephric mesenchymal differentiation and nephrogenic rests

**Table 1** Staging system of pediatric renal tumors according to the International Society of Pediatric Oncology with some comments on comparison with the National Wilms Tumor Study (NWTS) staging

| | |
|---|---|
| **Stage I** | A: Tumor is limited to kidney and is completely resected (resection margin clear) |
| | B: The tumor may be protruding into the pelvis and protruding into the ureter (but not infiltrating the walls) |
| | C: The vessels of the renal sinus are not involved (Comment: The NWTS allows renal sinus vessel involvement not more than 2 millimeters) |
| | D: Intrarenal vessel involvement may be present |
| **Stage II** | A: The tumor extends beyond the kidney or penetrates through the renal capsule and/or fibrous pseudocapsule into perirenal fat but is completely resected (resection margin clear) |
| | B: The tumor infiltrates the renal sinus and/or invades blood and lymphatic vessels outside the renal parenchyma but is completely resected |
| | C: The tumor infiltrates adjacent organs or vena cava but is completely resected |
| **Stage III** | A: Incomplete excision of the tumor, which extends beyond the resection margins |
| | B: Any abdominal lymph nodes involvement |
| | C: Tumor rupture before or intraoperatively |
| | D: The tumor penetrates through the peritoneal surface |
| | E: Tumor thrombi present at resection margins of vessels or ureter, transected or removed by surgeon |
| | F: The tumor has been surgically biopsied (wedge biopsy) prior to preoperative chemotherapy or surgery |
| | *Comment:* This category is similarly defined as 'Residual nonhematogenous sprading is present and confined to abdomen' by NWTS. |
| **Stage IV** | Hematogenous metastasis (lung, liver, bone, brain, etc.) or lymph node metastases outside the abdominopelvic region |
| **Stage V** | Bilateral renal tumor at diagnosis |

which is a predisposing pathology of WT. Somatic mutations of CTNNB1 areconcomitantlydetectedin 50-75% of tumor samples with WT1 mutations[21,22]. Defective WT1 expression and CTNNB1 mutation leads to pathologic nuclear accumulation of beta-catenin protein, activation of Wnt signaling and tumorigenesis[23]. This WT1/CTNNB1 molecular subtype is associated with nephrogenic rests [21]. Other candidate genes for WT include WTX on chromosome Xq11.1[24], IGF2 on chromosome 11p15 and POU6F2 on chromosome 7p. Loss of heterozygosity at chromosome 1p and 16q is associated with poorer outcome and are used as indicators for more intensive therapy in some protocols.

The recent study of a molecular marker for CCSK has discovered in-frame internal tandem duplication of exon 15 of BCOR as the molecular signature of the tumor. Another mutually exclusive genetic pathology with BCOR duplication in CCSK is YWHAE-NUTM2 fusion[19]. Germline mutations of SMARCB1, a member of the SW1/SNF chromatin remodelling complex, are predisposing lesions of MRTK[20]. Reciprocal fusion of PRCC-TFE3 is a predominant genetic alteration in PRCC[25]. Some of these genetic markers have been studied in terms of therapeutic targets of small molecules or antibody therapy.

## Multidisciplinary Care of Pediatric Renal Cancers

As with other pediatric solid tumors, care of patients with pediatric renal cancers requires a multidisciplinary approach. Currently, there are 2 main stream algorithms used in the management of WT, one from the International Society of Pediatric Oncology (SIOP) in Europe and the other from the National Wilms Tumor Study (NWTS) of the Children's Oncology Group (COG) in the US. While the SIOP promotes upfront chemotherapy before a nephrectomy (SIOP WT 2001) with an aim to reduce intraoperative spillage, the COG prefers a primary nephrectomy unless the tumor is considered unresectable. Major criticisms of the SIOP regimen involve the potential of inappropriate chemotherapy being given to non-Wilms tumor cases due to limited sampling of tissue from pre-treatment biopsy[26] and unreliable surgical staging when surgery is performed after the tumor has shrunk. According to the TPOG regimen for WT, chemotherapy can be given upfront or after a nephrectomy. In Songklanagarind Hospital, we have found that the risk of intraoperative rupture increases when the tumor size is larger than 10 centimeters[27]. Following that study, we chose to give pre-operative chemotherapy in WT cases with large tumor volume after an image-

guided biopsy. In order to avoid toxicity from high-dose chemotherapy and because there is a higher incidence of non-WT in the age group less than 6 months, immediate surgery after diagnosis is preferable.

The basic chemotherapeutic regimen for WT consists of vincristine and dactinomycin (regimen E, ThaiPOG-WT-1301). Patients with stage I-II and favorable histology receive 18 weeks of regimen E while those in stage I-II with focal anaplasia, stage I with diffuse anaplasia and stage III-IV receive 24 weeks of this basic combination plus doxorubicin (regimen D or TPOG-WT-1302). WT stages II-IV with diffuse anaplasia receive a combination of vincristine, doxorubicin, cyclophosphamide and etoposide (regimen I or TPOG-WT-1303). In patients with bilateral disease, carboplatin is also added to the protocol. Radiation therapy is given to stage III WT, either indicated by intraoperative spill or preoperative rupture or peritoneal seeding. Because the extent of radiation application depends on the area of tumor contamination, a careful record of operative findings is mandatory. Recent data from COG protocol AREN0532 suggests that patients in the 'very low risk' category of WT, referring to patients with stage I WT with favorable histology, tumor weight less than 550 grams and age at diagnosis less than 2 years, may receive a radical nephrectomy without adjuvant chemotherapy[28].

## Surgical Management

There are 4 types of surgery for pediatric renal cancers: primary nephrectomy, delayed nephrectomy following neoadjuvant treatment, metastasectomy and emergency surgery in cases of life-threatening conditions such as rupture or hemorrhage. In an elective nephrectomy for a unilateral tumor, care should be taken to evaluate the contralateral kidney for synchronous disease and other pathologies such as nephrogenic rests. A coagulation study should be performed in all cases as acquired von Willebrand disease can be found in 8% of WTs and the condition may cause significant bleeding until the renal vessels are completely ligated[29,30]. Systemic hypertension can be a paraneoplastic manifestation caused by renin production or renovascular involvement of the tumor. Evaluation of the renal vein and vena cava for possible tumor thrombus by ultrasonography is essential as CT is less sensitive in this situation. Intraoperative ultrasound may add information regarding the intrarenal extent of a tumor and its thrombus[31].

In a non-complicated unilateral WT, the objectives of surgery are removal of the affected kidney together with the renal capsules, vessels and ureter of the ipsilateral side, and gathering information for surgical staging via lymph node sampling (Table 2). The preferred approach is transperitoneal and our preferred incision is a long midline incision. Even if

**Table 2** Principles of nephrectomy for pediatric renal cancers

1. Standard radical nephrectomy (primary or after chemotherapy) in a unilateral tumor
   - Abdominal approach through a transverse curvilinear incision or a long midline incision
   - Thorough exploration, looking for peritoneal seeding, capsular leak and any thrombus within the renal vein, vena cava or ureter.
   - Right-side tumor may lie close to the liver surface, but rarely adheres or invades the parenchyma, while a left-side tumor may lie close to the pancreatic tail and spleen
   - Vascular control first, especially in a large tumors
   - Adequate mobilization of the ipsilateral colon, liver (right-side), spleen and pancreas (left-side) to the median help expose the tumor
   - Keep the dissection outside the renal capsule. Avoid tumor rupture
   - The ureter should be followed down to the ureterovesical junction
   - In cases of adherence, organ removal is rarely required
   - Lymph nodes sampling is mandatory for staging
   - Any leaks and spills MUST be clearly recorded
   - Drainage is optional
2. Nephron sparing surgery (indicated in bilateral diseases or a single renal unit)
   - Preoperative chemotherapy reduces surgical risk
   - Anatomical and functional planning before the procedure
   - Intraoperative ultrasound helps delineate the surgical margins
   - Warm ischemic time is only 30 minutes. Avoiding ischemia or reducing the temperature may help preserve the nephrons.
   - Adequate hemostasis
   - Drainage is mandatory

the tumor size is large, the "vascular control first" approach is possible and amenable to reducing intraoperative major hemorrhage, hence allowing "slow but safe" mobilization and low chance of intraoperative rupture. The midline vascular looping that has been widely used in renal trauma surgery can be applied well in this situation (Figure 2). After vascular control, the colon is mobilized from the anterior surface of the kidney A large left-sided tumor can adhere to the spleen, pancreatic tail and diaphragm. A right-sided mass may look inseparable from the posterior surface of the liver on CT scan, however direct invasion to the liver is uncommon. If the tumor adheres to the diaphragm, resection of a small portion may prevent tumor rupture[32]. However, resection of other adjacent organs should be avoided as the additional procedure may complicate the post-operative course. Mobilization of the kidney is performed outside the Gerota's fascia. After full renal mobilization, the ureter is followed down to the ureterovesical junction, then truncated and removed with the specimen. If the renal capsule is accidentally rupture during the operation, spillage should be controlled as quickly as possible and the extent of the contamination from the spill should be clearly noted as this will be necessary to plan the locoregional adjuvant radiotherapy. For complete staging, lymph nodes around the renal hilum and along the course of the renal vessel on the same side (peri-aortic on the left and pericaval on the right) should be sampled for histopathology. A recent analysis from the COG suggested that at least 7 lymph nodes should be sampled for optimal staging accuracy[33]. Care should be taken to close all mesocolic defects before closure of the abdomen. In general, a drain is not necessary unless there remains oozing from a raw surface. Post-operative care focuses on hemodynamic monitoring, adequate hydration, pain control and early enteral feeding resumption. Nephron-sparing surgery (partial nephrectomy) is not a current standard of care in unilateral WT because of an unacceptably high incidence of positive resection margins although survival outcomes might not be compromised. Unclear oncological benefits and technical difficulty makes nephron sparing surgery unpopular at the moment[34]. However, nephron sparing surgery is suggested in unilateral cases with genetic syndrome, nephrogenic rests or preoperative renal dysfunction[35]. A recent long-term split-renal function study after partial nephrectomy suggested that children have a relatively high capacity for compensatory growth of the operated-on kidney[36].

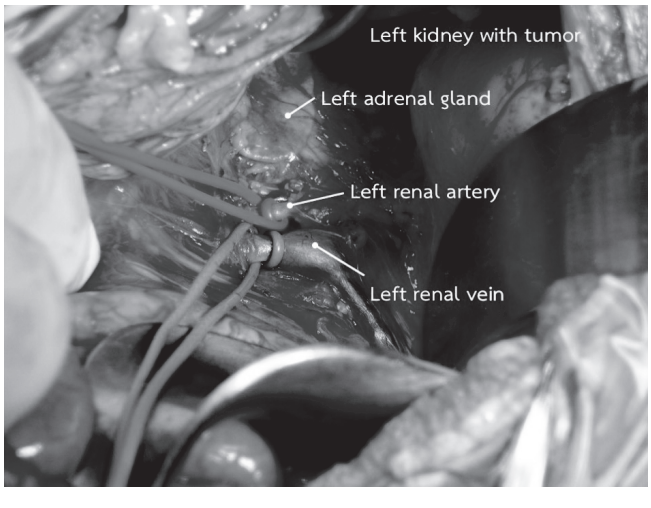



**Figure 2** Intraoperative picture demonstrating the technique of midline vascular looping in a case of left-side Wilms tumor. Note that the vascular identification is performed through the mesocolon. With this ùcontrol firstû strategy, further mobilization can be done with less risk of inadvertent bleeding. Avoiding a blood-filled operative field allows the entire operation to be performed meticulously.

Minimally invasive surgery has been recently introduced to WT surgery in experienced centers[37, 38]. A study suggested that laparoscopic nephrectomy became more feasible after chemotherapy. However, laparoscopic sampling of lymph nodes, which is crucial for accurate staging, requires higher experience[38]. A novel technique known as zero-ischemia laparoscopic assisted partial nephrectomy has been shown to have the advantages of rapid recovery and better cosmesis. The zero-ischemia technic uses a laparoscopy to assist with lymph node sampling and renal mobilization within the abdomen. The kidney is then brought out through a small flank incision to perform a partial nephrectomy without total hilar cross clamping.

## Complicated Situations in Nephrectomy

Certain situations in a nephrectomy for pediatric renal tumor are technically challenging. Examples of such situations include a tumor with thrombus extending into a renal vein or a ureter, bilateral WT or a unilateral tumor in a single renal unit, pre-operative rupture and hepatic metastasis. If possible, surgical

treatment of WT in these conditions should be preceded by neoadjuvant therapy.

### *1. Bilateral disease*

Approximately 5% of WTs in large cohorts present with bilateral disease at the time of diagnosis. This group of WTs has a high chance to have some types of predisposing genetic syndrome including intrinsic renal pathology such as nephrogenic rests. The tumor masses and the associated pathologies leave the patient with bilateral WT at risk of renal insufficiency after surgical removal of the tumors. End-stage renal disease was reported in 10% of bilateral WTs, compared to 1% in unilateral tumors[39]. Nephron-sparing surgery after tumor down-sizing by chemotherapy is the current standard management in both the COG and SIOP protocols[40]. Tumor biopsy is not recommended unless an evaluation by imaging after 6 weeks of therapy does not show substantial response to chemotherapy.

Partial nephrectomies can be performed bilaterally during the same operation. Careful anatomical planning is necessary using an arterial phase CT scan, focusing on the renal vessels and kidney volume (Figure 3). In general, at least 50% of the renal volume on each side should be retained in order to avoid renal insufficiency in the postoperative period. A 99mTc-dimercapto-succinic acid (DMSA) scan may help in an assessing of split renal function per volume of non-tumorous parenchyma[36]. The preferred

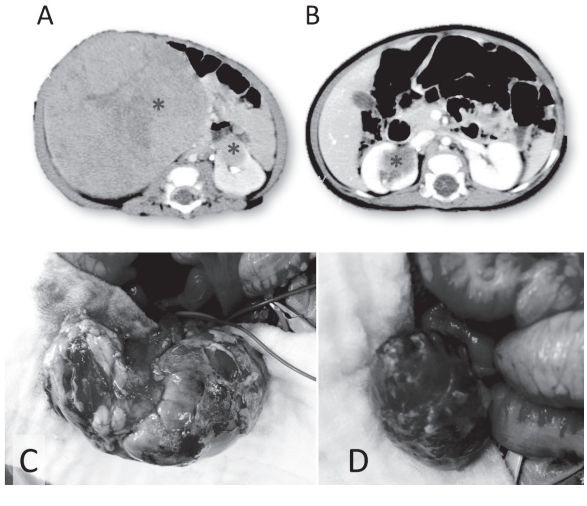



**Figure 3** A case of bilateral Wilms tumor. A-B) CT scans demonstrating tumors (asterisks) and reduction of tumors after chemotherapy C) Operative findings of the remaining tumor on the right kidney D) The right kidney after nephrectomy.

incision in our institute is a long midline incision. In order to spare the better kidney in case of unexpected complications, the operation is usually begun on the side with higher anatomical risk. The colon is reflexed medially, allowing clear exposure of the renal vessels. The renal arteries and veins are separately controlled but total perfusion shutdown should be avoided as reperfusion injury may harm the functions of the residual parenchyma. Experimental clinical studies have shown that the warm ischemic time of a kidney is 30 minutes[41-43]. Cooling down the operative field using crushed ice may help increase renal tolerance to the ischemia. Modern surgical devices such as harmonic scalpel can facilitate parenchymal dissection by its advantages in vascular sealing ability and less collateral damage[44].

The open collecting system should be closed with fine absorbable sutures. A double J stent is routinely used to facilitate urine flow by some surgeons[6]. A soft drain, e.g. a Jackson-Pratt silicone catheter, is left in-place until a few days after urethral catheter removal and there is no excessive urine leak. Communicating with a pathologist to focus on the resection margin is advisable as adjuvant radiation therapy is indicated in cases with positive border[45].

### *2. WT in a single renal unit*

The situation may occur in a patient with a horseshoe kidney or it can be a metachronous tumor arising in the only remaining kidney.

### *3. WT with extrarenal extension*

Venous extension of WT was reported at 4% and 6% in NWTS-3 and NWTS-4, respectively, and this locally advanced tumor leads to a higher risk of surgical complications[46,47]. According to NWTS-4 data, 82% of venous extensions are confined to the vena cava while 18% had atrial extension. Although most patients have no specific symptoms, some may present with vena cava obstruction, cardiac failure or testicular varicocele. Upfront chemotherapy is the current standard for first treatment, even in those cases with venous obstruction, as a study showed that 70% of the cases had substantial response to this approach[48]. Before surgery, apart from a CT scan, evaluation of thrombus extension and possible venous obstruction can be performed using ultrasonography with or without a Doppler flow detector (Figure 4). When the thrombus extends

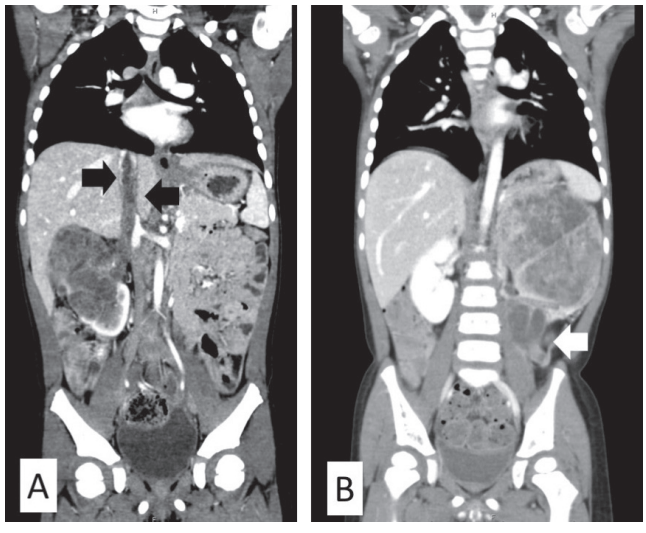


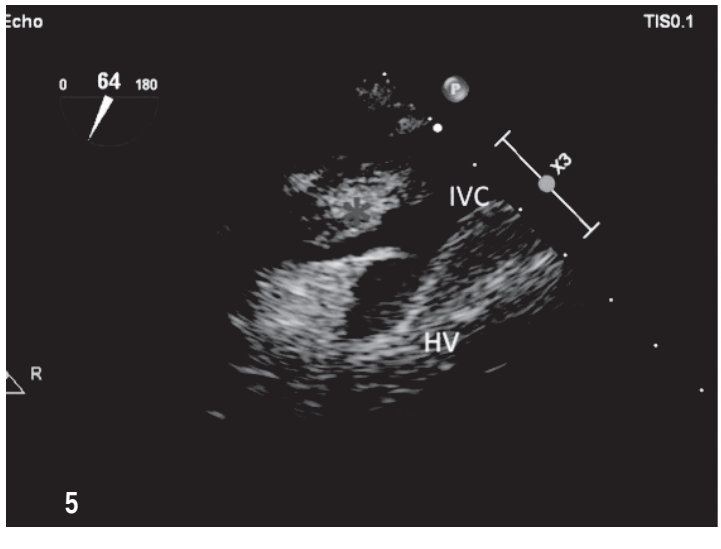

**Figure 4** Wilms tumor with extrarenal extension A) Intracaval extension of the right-side Wilms tumor (black arrows) B) Left renal pelvic and ureteric extension of a left-side Wilms tumor (white arrow)

beyond the retrohepatic vena cava, stand-by cardiac surgeon consultation and cardiopulmonary bypass is recommended[49]. The main vascular access should be on the upper part of the body as impeded flow during vena cava control may result in preload reduction and hypotension.

After a radical nephrectomy, vascular control by snuggling with silicone slings is performed above and below the intended cavotomy site. If the tumor thrombus extends to the retrohepatic vena cava, right hepatic mobilization can facilitate vascular control. Additional retrohepatic or suprahepatic vena cava control reduces the risk of embolism during a thrombectomy. A longitudinal venotomy is made and removal of the thrombus can be performed using stone forceps extraction together with manual milking from above. Dissection of the thrombus from the intimal plane is necessary in some cases[49] if the thrombus has adhered to the venous wall. However, if the cranial end of the thrombus has adhered to the vein above the diaphragm, removal through a cardiotomy under circulatory arrest is recommended (Figure 5). In our experience, a transesophageal ecchocardiography is helpful in evaluating the level and completeness of a caval thrombectomy. Venous extension of other pediatric renal tumors other than WT can also occur and the current principles of treatment are similar. Ureteric extension requires careful mobilization of the ureter down to a point that is free from tumor thrombus. If vesical extension is doubtful, a pre-operative cystoscopy is suggested.

### *4. Renal tumor with synchronous hepatic metastasis*

Synchronous hepatic metastasis at diagnosis was reported in 29 of 1365 WT patients (2.1%) by SIOP enrolment (1994-2004)[50] and 111 of 4,941 WT patients (2.2%) registered to NWTS-4 and NWTS-5[51].



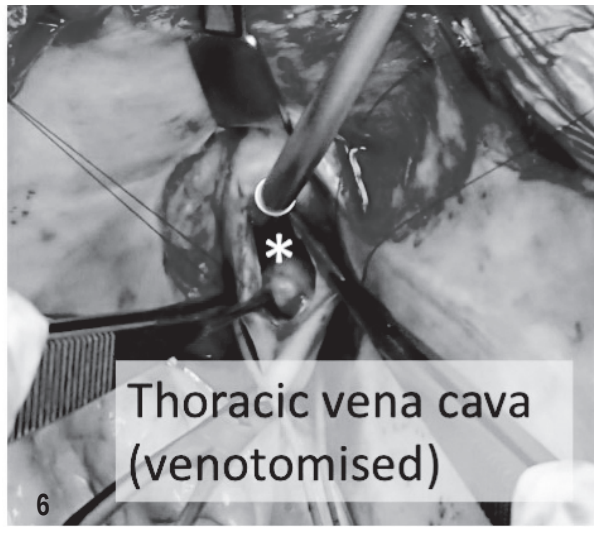




**Figure 5** Operative findings in a case of venous thrombus extending to the thoracic vena cava. The thrombus was found floating within the vein and was removed under circulatory arrest.

**Figure 6** Intraoperative transesophageal echocardiography showing a tumor thrombus (asterisks) floating within the inferior vena cava (IVC) above the hepatic vein (HV) and the operative findings in the same patient (courtesy of Dr.Jutarat Tanasansuttiporn, Department of Anesthesiology, Faculty of Medicine, Prince of Songkla University)

Approximately 65% of those with primary liver metastasis also had lung metastasis at diagnosis. Data from the NWTS showed better survival outcome in cases who underwent a primary liver resection compared to those who did not (5-year event free survival 86% and 68%, respectively) although the difference did not reach the statistical significance level[51]. However, it is generally advisable that if the nephrectomy is uncomplicated and the hepatic metastasis is considered resectable, the nephrectomy and hepatic resection should be performed together in one operation.

## Sugical Management of Metastatic Renal Tumor

Although lung, liver, bone and brain are the predominant sites of metastasis in WT and bone metastasis often occurs in CCSK, uncommon metastatic sites have also been reported such as adrenal glands, vagina and duodenum[52-54]. Pulmonary metastasectomy has been proven to provide survival benefits when the patient has a solitary metastasis at the lung[55]. Surgery for WT metastasis to the liver has long been supported by a landmark retrospective review in 1978[56]. Although most supporting data are derived from small case series, analysis from SIOP data also emphasise the significance of complete resection of the metastatic foci[57].

## Complications in Pediatric Renal Tumor Surgery

Surgical complications occur in approximately 12% of renal tumor surgeries. The most common surgical complication in WT surgery is intraoperative rupture which was reported at 15% in the NWTS study and 3% in the SIOP study[58-60]. In our series from Songklanagarind Hospital, the risk of operative rupture/leak increased when a primary nephrectomy was attempted in a case with tumor size larger than 10 centimeters[11] which was consistent with a report from NWTS[47] and also others[61,62]. To avoid this complication, we opt to give upfront chemotherapy in large pediatric renal tumor. Other complications include intestinal obstruction from adhesion, major vascular injury, excessive bleeding, and surgical site infection[47].

## Sugery for Recurrent Disease

Locoregional relapse occurs in 10-15% of WT after primary nephrectomy and intraoperative spillage increases the risk of relapse. Apart from intraoperative leakage from the renal capsule, spillage includes unintentionally breaking into a vessel or a ureter that contains viable tumor cells. When recurrence occurs, longterm survival is significantly compromised. The first line treatment is an intensive chemotherapy regimen with a combination of ifosfamide, cyclophosphamide and etoposide[63]. After chemotherapy, removal of the residual tumor gives favorable outcomes in cases that the tumor is resectable[64].

## Current Outcomes of Renal Tumor Management

Reported outcomes of WT from large trials have been generally excellent other than for patients in unfavorable subgroup. According to a recent post-hoc analysis using the UMBRELLA protocol by the SIOP renal tumor study group, localized WT had an estimated 5-year survival of more than 90% with survival in stage I reaching 100%[65-67]. In metastatic WT or bilateral diseases, 5-year survival have been reported at 70%[17]. Survival for those with bilateral WT was recently reported at 95% (AREN0534 protocol from COG)[68]. Survival rates decrease in patients with unfavorable histology or molecular markers, with large tumor volume or when there is intraoperative spillage[69]. In non-WT renal tumors, 5-year survival is around 80% in CCSK[70,71] and less than 25% in MRTK[72].

## Conclusion

Although evolution in the treatment of pediatric renal tumors has come to the point that cure can be aimed at in the majority of cases, challenging circumstances still exist. In most complicated situations, pre-operative chemotherapy leads to reduction of tumor size and inactivation of metastatic foci, allowing tumor resection with less risk of renal insufficiency or inadvertent complications. Surgical resection plays a role not only in primary tumors but also in metastatic WT in the lungs or liver in case in which the primary tumor has been well controlled. WT and CCSK are curable cancers when diagnosed at an early stage with no unfavorable prognosticators.

## Acnowledgement

Dave Patterson edited English language in the manuscript.

## Ethical Issue and Conflict of Interest

The authors declare no conflict of interest.

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# *Abstracts of the 43rd Annual Scientific Congress of the Royal College of Surgeons of Thailand, 27-30 July 2018, Ambassador City Jomtien Hotel, Pattaya, Cholburi, Thailand (Part 2)*

## ACS BASIC SCIENCE

### A PROSPECTIVE RANDOMIZED TRIAL TO COMPARE TIME TO COMPLETE LAPAROSCOPIC SKILL TEST BETWEEN 3D IMAGING SYSTEM AND ULTRA-HIGH DEFINITION (4K) LAPAROSCOPIC SYSTEM

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**Background:** 3D (Three dimensional) imaging system can improve depth perception of surgical field and have many studies have shown that can improve inanimate laparoscopic skill compared with 2D system. Development of 4K (Ultra high definition) imaging system, the advantage includes more detailed, color-correct images and greater depth perception. We compared the effect of 4K imaging system to time for complete laparoscopic skill test over 3D imaging system

**Method:** Sixth year medical student and first year resident were assign in to two groups (3D first and 4K first) to perform 3 laparoscopic skill test (ring transfer, pattern cutting, suture/knotting) of both system. Time to complete all tasks and each tasks were measured and number of mistake were noted in both groups. All participants completed questionnaires about inconveniences that was occurred when performed skill test.

**Result:** Time to complete all tasks in 3D imaging system was shorter than 4K imaging system (661 seconds vs. 746.88 seconds, $p<0.001$). If we considered time to complete each task, the result showed shorter time in 3D imaging system than 4K. Time to complete task 1 in 3D system and 4K system were 101.42 +/- 22 seconds and 118.79 +/- 35 seconds respectively ($p<0.001$), for task 2 time to complete task in 3D system and 4k system were 304.58 +/- 49 seconds and 330.21 +/- 67 seconds respectively ($p<0.001$). Time to complete task 3 were 255 +/- 64 seconds and 297 +/- 90 seconds respectively ($p=0.02$)

**Conclusion:** The 3D vision systems significantly improved speed and accuracy when compared to the 4K vision system based on shorter performance time in non experience trainees.

## ICS INVENTER AWARD

### DEVELOPMENT OF MICRO COMPUTED TOMOGRAPHY (MCT) SCANNER FOR LOCALIZATION LESION AND ASSESSMENT OF THE MARGIN WIDTH OF RESECTED BREAST SPECIMEN IN THE OPERATING ROOM

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**Background:** After the non-palpable microcalcification in breast tissue detected by mammogram was removed. The resected specimen must be examined by the x-ray in order to define that the calcification is inside the specimen or not. The x-ray imaging was routinely done at the mammogram x-ray machine or in the specific desired x-ray machine. The imaging process mostly be done at the outside operating room. And the image was achieved in 2D (2 dimension) plane. The location of calcification in the 2D image is vary depend on the direction of specimen that anchor on the film. The calcification that locate at the margin area is the indicator of incomplete resection.

**Objective:** The objective is to develop the micro CT scanner machine and software dedicate for localization of calcification in the resected breast tissue specimen in 3 dimensional images. The machine is portable and can be used in the operating room.

**Materials & Methods:** The system design is to 360 degree scan the specimen on the rotating table between the x-ray source and the detector sensor. The scan is the cone beam technique. The developing prototype machine was the collaboration between Prince of Songklanagarind University and NSTDA (National Science and Technology Development Agency, Thailand). The micro CT scan (MiniiScan®) was designed to be used as mobile machine and can be used in the operating room. The overall scan time and the image reconstruction is about 5-10 minutes. The machine is test for the safety by the PTECT of Thailand.

**Results:** This paper reports the preliminary result of 3D reconstruction of the resected breast tissue specimen by using the MiniiScan®. The scan of the specimen intraoperation in 31 patients is under evaluation form June 2016 to January 2018. The scan tome was 10.4 minutes. The preliminary report of the image quality is comparable to the conventional x-ray specimen done by the mammogram machine but the waiting time was 27.9 minutes in the conventional technique.

**Conclusion:** The prototype of the intraoperative MiniiScan® scan is test for quality of image and waiting time for report. The paramedic personal can operate the machine at the operating room instead of the conventional x-ray done at the mammogram machine outside the operating theater.

## PISITH VISESHAKUL AWARD

### OUTCOMES OF NON-OPERATIVE MANAGEMENT OF SPLENIC INJURY: RETROSPECTIVE COHORT FROM A LEVEL 1 TRAUMA CENTER

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**Background:** Non-operative management (NOM) of splenic injury is standard management for hemodynamically stable patients. However, it may be a challenge in developing countries with limited intensive care resources. This study aimed to review the outcomes of NOM of splenic injury in a level 1 trauma center in Thailand.

**Methods:** This was a retrospective review from a prospectively collected trauma registry. The study enrolled patients who had splenic injury and underwent NOM from 2009 to 2016. Failure of NOM was defined as needed an operation on the spleen after NOM. The outcomes of NOM were described and the predictors of failure of NOM were identified.

**Results:** Seventy-two splenic injury patients were included in the study. Motorcycle crash was the most common mechanism of injury (60%). The average Injury Severity Score was 20. Sixty-two patients (86%) were successfully treated as NOM. Six patients underwent embolization and one of them required operative management. The total lengths of stay in successful NOM and failure of NOM were equal, respectively. From a univariate analysis, hemoperitoneum ≥ 4 regions (odds ratio [OR] 3.96, 95% CI 0.79-25.53; $P$= 0.05) and blood transfusion >2 units in 24 hours (odds ratio [OR] 20, 95% CI 2.15-242; $P$= 0.003) were significantly associated with failure of NOM. The most common complication after NOM was splenic infarction.

**Conclusions:** NOM of splenic injury can be done successfully in a high level trauma center in a southern Thailand. The amount of hemoperitoneum and unit of blood transfusion in 24 hours was a significant predictor of failed NOM.

## PREDICTION OF MASSIVE TRANSFUSION IN TRAUMA PATIENTS IN THE SICUS (THAI-SICU STUDY)

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**Background:** Resuscitation in the SICUs is crucial for trauma resuscitation. Blood transfusion is needed for restoration of the physiology. This study had the objective of finding the predictors of massive transfusion in the SICUs in trauma patients and aimed to use those predictors to help clinicians prepare blood products for patients in a timely manner.

**Methods:** This was an analysis of a prospective cohort study (THAI-SICU Study) conducted in the nine university-based SIUCs in Thailand. The study included only patients admitted in the SICUs due to trauma mechanisms. Burn patients were excluded. Massive transfusion was defined as receipt of ≥ 10 units of packed red blood cells on the first day of admission. Demographic data and physiologic data were analyzed to identify the predicting factors. Multivariable regression analysis was performed for a final model.

**Results:** Three hundred and seventy patients met the eligibility criteria. Sixteen patients (5%) required massive transfusion in the SICUs. The factors that significantly predicted massive transfusion were an initial SOFA ≥ 9(RD 0.13, 95% CI 0.03 to 0.22, $p$=0.01), intra-operative blood loss ≥ 4900 mL (RD 0.33, 95% CI 0.04 to 0.62, $p$=0.02), and intra-operative blood transfusion ≥ 10 U (RD 0.45, 95% CI 0.06 to 0.84, $p$=0.02). Patients with all 3 factors had a 97.6% probability of a massive transfusion in the SICUs.

**Conclusions:** Massive blood transfusion in the SICUs occurred in 5%. An initial SOFA, intra-operative blood loss, and intra-operative blood transfusion were the significant factors to predict massive transfusion in the SICUs.

## THE DISPARITY OF MICROORGANISMS IN BLAST WOUND INFECTION

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**Background:** The International Committee of the Red Cross (ICRC) antibiotic protocol had suggested that Penicillin with or without Metronidazole should be used as empirical antibiotics. This protocol was aimed to cover mostly gram positive and anaerobic bacteria whereas recent studies suggested that gram negative bacteria were the predominant organisms in blast wound infection.

**Objectives:** The aims of this study are classified microorganisms of wound infection in blast-related traumatic patients in PSU hospital and to identify incidence, onset, risk factors and septic complications of wound infection on blast-related traumatic patients in PSU hospital.

**Materials and Methods:** Data were collected on blast-related trauma patients who were registered on trauma registry database at Songklanagarind hospital between January 1, 2009, and December 31, 2015. Data collection was performed by reviewing medical records of registered trauma patients. An initial descriptive analysis was performed for every variable. Numerical variables were presented as mean ± SD or median (IQR) respectively. Categorical variables were presented as frequencies or percentage. Logistic regression was used for analyzing data set to identify risk factors of blast wound infection.

**Results:** Microorganisms that caused wound infections in blast-related trauma patients of a total of 51 wound infections, gram-negative bacteria were the most common isolated overall 82%, gram-positive bacteria and fungal infection were isolated 31% and 4% respectively. Mixed organisms accounted for 20% of all blast wound infection. Pseudomonas spp., Acinetobacter spp., and Escherichia coli are predominant gram-negative bacteria that were isolated from blast wound infection. There are some multidrug-resistant microorganism such as gram-negative bacteria with ESBL positive and MDR Acinetobacter spp. among blast-related trauma patients who had wound infection. While Candida spp. is the most common organism that caused fungal infection. For potential risk factors, traumatic amputation and ICU admittance seemed to significantly increase risk of wound infection in blast-related trauma patient.

**Conclusion:** In conclusion, this study showed the predominant microorganism isolated from infected wound of blast-related trauma patient was gram-negative bacteria. Acinetobacter spp., Pseudomonas spp. and Escherichia coli were the most common gram-negative bacteria respectively. Patients who have traumatic amputation and/or ICU admittance have higher risk of wound infection.

## POSTER COMPETITON

### FLUORESCENT IMAGING WITH INDOCYANINE GREEN FOR INCREASE IDENTIFICATION RATE OF SENTINEL LYMPH NODE IN BREAST CANCER SURGERY: NEW EXPERIENCE IN THAILAND

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**Background:** The radioisotope and blue dye has been used for identify sentinel lymph nodes (SLNs) for axillary staging in breast cancer. Fluorescent imaging with Indocyanine Green (ICG) is a recently developed modality for lymphatic mapping of SLNs and is a relatively new procedure in Thailand.

**Objective:** To estimate the identification rate of SLNs for the ICG method, compare with those of the radioisotope and blue dye methods, and to report the complication associated with the ICG technique.

**Materials & Methods:** Fifty-five women with early breast cancer had a periareolar injection of ICG, radioisotope and blue dye for detect SLNs. Identification rate of all methods were compared.

**Results:** ICG imaging identified SLNs in 54 of 55 patients ( 98% identification rate). Radioisotope and blue dye identified SLNs in 50 and 48 patients respectively. The mean number of SLNs identified by ICG technique was 3.1 nodes. There was no perioperative complication from ICG in all patients.

**Conclusion:** Fluorescent imaging using Indocyanine Green (ICG) is safe and is associated with a higher identification rate as compared with those of radioisotope and blue dye methods.

### INTRAOPERATIVE 3D MINIISCAN® TO DETERMINE ADEQUATE MARGINS OF BREAST SPECIMEN WITH ABNORMINAL MICROCALCIFICATIONS BEFORE HISTOPATHOLOGICAL EXAMINATION

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**Background:** Breast calcification is an important feature in the radiological assessment of breast lesions. Abnormal calcifications classified as BIRADS 4 or 5 are indicated for tissue diagnosis. In practice, guided-wires are often used to localize these lesions. Various modalities are used to assess the adequacy of surgical resection to minimize pathological positive margin and reoperation rates. Currently most institutions used conventional specimen mammography. MiniiScan® is a new method of intraoperative specimen radiography for margin evaluation following breast lesion excision. The concept of MiniiScan® is similar to that of computerized tomography, but specimen is rotated on the plate instead of using circular rotating frame with an x-ray tube mounted on 1 side and a detector on the opposite side as in conventional CT scans. Reconstruction into 3 dimensional images is easily done in a short time. The MiniiScan® device was developed jointly by Songklanagarind hospital and the National Science and Technology Development Agency, Thailand.

**Objectives:** To compare the MiniiScan® imaging with conventional specimen mammography in terms of specimen margin positivity rates, as well as the operative time.

**Materials & Methods:** A medical records review of patients with abnormal calcification (BI-RADS 4 or 5) who underwent wire-localize excision from 1 June 2016 to 31 January 2018 at Prince of Songkla University was done.

**Results:** There were 31 patients in the study. The mean age was 56.8 years. Abnormal calcifications were classified as BI-RADS 4b in 52% of patient. The average specimen imaging times was 27.9 minutes and 10.4 minutes in the conventional specimen mammography and MiniiScan® (group, respectively. There are 9 patients with DCIS and all specimens were determined to have free margin by both radiologic methods. Final pathological results revealed negative margin all 9 specimen.

**Conclusion:** MiniiScan® reduces the operative time required for wire-guided tissue biopsy for abnormal calcifications and is readily integrated into routine care.

### NOCTURIA AND EFFECT TO QUALITY OF LIFE

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**Background:** Nocturia quality of life questionnaires (N-QoL) has been developed and used worldwide.

**Objectives:** This study aim to explore the impact of nocturia on QoL in Thai patients, and to examine the association between Thai-translated N-QoL and urination at night.

**Materials and Methods:** The cross-sectional study was conducted on nocturia patients at Ramathibodi Hospital, Thailand. Uni- and Multivariate analyses were used to explore association among urination at night, patient's characteristics, and N-QoL scores.

**Results:** One hundred fifty-five nocturia patients (81% of whom was male, with mean age ± SD of 68 ± 9 years) were surveyed. The translated questionnaire met the reliability standard for internal consistency with Cronbach's α of 0.884. In terms of the domain Sleep/Energy, more than half of the patients reported the associations between nocturia low energy (55%), inadequate sleep at night (67%) which required napping during the day (72%). Most patients (87%) reported that nocturia was not the cause of fluid restriction. In terms of the domain Bother/Concern, more than half of patients were worried over condition worsening (57%). Approximately 70% of patients reported that nocturia bothered their life. Nocturia of more than twice per night was considered bothersome ($p$ 0.022, sensitivity 71%). The average overall N-QoL score (± SD) (100 indicating the best conditions) was 79 (16) and had significant relationship with overall QoL ($p$ <0.001). Increasing of number of urination per night and urinary continence significantly decreased overall N-QoL scores ($p$ 0.002 and $p$ 0.035, respectively). Number of urination, urinary incontinence, and/or time to first urination significantly predicted the impact levels in 9 od 12 N-QoL question.

**Conclusions:** Nocturia had significant impact on QoL. The number of urination at night could predict for overall N-QoL scores but did not relateto several questions in the N-QoL questionaires. Nocturia more than 2 per night should be given more attention.

## TEN CASES REPORT OF TRANSORAL ENDOSCOPIC THYROIDECTOMY VESTIBULAR APPROACHED (TOETVA) AFTER PREVIOUS TOETVA SURGERY

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**Background:** Transoral Endoscopic Thyroidectomy Vestibular Approach (TOETVA) is an upcoming surgical technique. In some cases we need reoperation for completion thyroidectomy. Nowadays, there is no report about redo TOETVA cases yet. From March 2014 to June 2017 in Police General Hospital a total of 680 patients underwent TOETVA using 3 laparoscopic ports inserted at the oral vestibule. Ten patients underwent redo TOETVA completion thyroidectomy. Six cases was performed TOETVA within two weeks. Other four cases was performed TOETVA after 6 months after TOETVA lobectomy. All procedures were done with the same TOETVA technique but there are some points that we must be concerned while operation.

Operative procedure step by step, the patient position is supine with neck hyperextended. At first incision mucosa at distal 1/3 of mucosa lower lip then hydro dissection was done by using NSS 500 ml mix with adrenaline1ampule. Total uses of Saline 30-50ml to created subplatysmalplane. Then blunt dissected subplatysmal plane by using dissector direction at midline and two lateral side. Then 10 mm port was insert at midline lower lip then hanging suture with silk (2-0) at 1finger breadth below end of the port. Then make a small incision at lateral end of lower lip for inserting 5mm port both side. Then created subplatysmal space by sharp dissection using energy sealing device such as harmonic. In this procedure some case had adhesion from previous surgery. So this step should be careful not to dissected too shallow, Always dissected below platysma .Then opened strap muscle jn midline by hook monopolar. Then separated strap muscle from thyroid gland. At superior pole, dissected Joll's space to identify superior thyroid vessel. Then lateral hanging suture most part of strap muscle at the level of cricoid cartilate by silk (2-0). Then ligation superior thyroid vessels, identified and protect superior laryngeal nerve, superior parathyroid gland. Then lateral dissected was done by grabbing thyroid then rotate thyoid gland to medial. Then dissected tissue separates inferior parathyroid .Then ligation Inferior thyroid vessels and then dissected tissue to identify recurrence laryngeal nerve separated nerve from thyroid tissue and berry ligament. Then dissected the rest of thyroid tissue from trachea. Finally central node dissection was done. All cases didn't placed drain.

**Results:** All cases were no conversion to opened thyroidectomy, no intraoperative complications such as bleeding, no neck skin flap burn, and recurrent laryngeal nerve injury. We can identify parathyroid glands and protect all of them. All patients have no post operative complication such as hoarseness, post operative hematoma, airways compression, hypocalcemia and neck skin flap necrosis.

**Conclusion:** Redo TOETVA can perform within 2 weeks or after 6 months after surgery. Careful dissection

must be concerned due to adhesion and to prevent complications.

## THE NON-RECURRENT LARYNGEAL NERVE AND THE TRANSORAL ENDOSCOPIC THYROIDECTOMY VESTIBULAR APPROACH (TOETVA)

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**Introduction:** The non-recurrent laryngeal nerve (NRLN) is a rare anatomic variation which is reported 0.3 to 0.8% of subject on the right side and 0.004% on the left. Nerve injury results in significant morbidity. NRLN has been reported and discussed in terms of technique used to identify and avoid injury in open thyroidectomy surgery.

Transoral endoscopic thyroidectomy vestibular approach (TOETVA) is a feasible and novel approach to thyroid surgery, with excellent cosmetic results. We reported 2 cases of NRLN found during TOETVA and discussed nerve identification techniques in TOETVA.

**Patients and Methods:** We performed 680 procedures using TOETVA from March 2014 to July 2017 at Police General Hospital, Bangkok, Thailand. The right NRLN was found in two patients. One is multinodular goiter and another with Graves' disease. Clinical data was recorded. Informed consent was obtained.

The first patient was a 35-year-old woman who presented with multinodular goiter for 4 years. Neck ultrasonography revealed multinodular goiter, with nodules ranging from 3 to 5 cm in size. FNA of dominant nodules was classified as Bethesda II. Total tyroidectomy via TOETVA was performed. A Type 2A right NRLN was found intraoperatively and very carefully preserved. There were no any complications such as hoarseness, hematoma, or hypocalcemia postoperatively.

The second patient was a 40-year-old woman presented with Graves' disease, who had failed medical treatment. Neck ultrasonography showed diffuse thyroid goiter with 6 cm in the largest diameter. The patient underwent total thyroidectomy via TOETVA. A type 2A right NRLN was found which we preserved safely. The postoperative period was uneventful

**Discussion:** The NRLN branches from cervical vagus nerve without looping around subclavian artery on the right side or ligament arteriosum on the left. There are three types of the NRLN: Type 1, 2A, and 2B. Our patients both had a type 2A NRLN, a classic type which is also commonly described in other reports.

TOETVA is an alternative novel technique for thyroid surgery which requires only conventional laparoscopic instruments. It avoids incisional scars and can be performed as safely as open thyroidectomy. Currently, our team has performed 680 procedures as of July 2017 - the largest number in the world.

We used meticulous capsular dissection technique, always aware that NRLN may be present. The prevalence of the NRLN in our series (0.3%) was in the same range as those of other reports (0.3 to 0.8%). Intraoperative nerve monitoring (IONM) may be used to help identify NRLN. Absence of signal at the right distal vagus nerve is an indicator of the presence of NRLN.

**Conclusion:** Careful dissection and awareness of NRLN are important for both endoscopic and open thyroid surgery. Intraoperative nerve monitoring under endoscopic visualization may better identify the RLN.

## TRANSVERSUS ABDOMINIS RELEASE (TAR) VS ANTERIOR COMPONENT SEPARATION (ACS) TECHNIQUES: FLAP ADVANCEMENT COMPARISON IN THE SOFT CADAVERIC

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**Background:** Complex incisional hernia is one of the challenges in treatment. Component separation was introduced in 1990 to treat complex incisional hernia. During that time, anterior component separation (ACS) was performed but there were complications from skin flap necrosis due to extensive dissection. Transversus abdominis release (TAR) was introduced in 2012 to prevent skin flap necrosis and preserved neurovascular bundle. We compare between ACS and TAR in terms oflength of flap advancement in soft cadaveric model.

**Method:** Six soft cadavers were opened in midline from xyphoid to pubic symphysis. On the right side, we performed anterior component separation by skin flap dissection and then external oblique muscle from subcostal to inguinal ligament was divided. Dissection proceeded between external oblique muscle and internal oblique muscle. On the left side of the abdominal wall, we performed transversus abdominis release by opening posterior rectus

sheath and opening linear semilunaris.After thatwe identified transversus abdominis muscle, divided transversus abdominis muscle and undermined between transversus abdominis muscle and transversalis fascia. We measuredthe length of flap advancement from midline of both procedures at subcostal margin, umbilical and anterior superior iliac spine (ASIS) respectively, and used t-test to compare between the two groups.

**Result:** The average length of flap advancement in TAR; subcostal margin = 30.00 mm, Umbilicus = 41.67 mm, and ASIS = 25.00 mm. The average length of flap advancement in ACS is 18.33, 23.33, and 15.50 respectively. All average length of flap advancement in TAR had statistical significance compared with ACS.

**Conclusion:** In soft cadaver, TAR's length of flap advancementis more than ACS with statistical significance.

## POSTER NON-COMPETITION

### A COMPARISON OF NEXUS CT AND FILM CHEST PLUS ABDOMINAL CT FOR IDENTIFYING THORACIC BLUNT TRAUMA

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**Background:** Nexus CT and CXR plus ACT were good decisive instruments for decreasing the use of unnecessary trauma thoracic CT but there was no clear information on selection preference.

**Objective:** To compare of NEXUS CT and CXR plus ACT for identifying thoracic blunt trauma.

**Method:** A retrospective analysis of the trauma registry at the Montreal General Hospital from April 1, 2014, to March 31, 2016 was performed. The inclusion criteria were older than 15 years, GCS > 12, blunt trauma injuries, admission in hospital and receiving CXR, TCT, and ACT.

**Result:** A total of 671 patients enrolled into the study. The median age was 57 years. 67.2% were male. Most trauma mechanism was falls (49.5%). 360 patients had total thoracic injuries and 143 had a major thoracic injury. Nexus chest CT-All for all thoracic injury'ssensitivity was 94.4% (95% CI 91.6-96.6) and specificity was 52.7% (95% CI 47.0-58.4). Nexus chest CT-Major had sensitivity and specificity for major thoracic injury of 97.2% (95% CI 93.0-99.2) and 45.4% (95% CI 41.3-50.0), respectively. CXR+ACT had sensitivities for all thoracic injury and for major thoracic injury of 65.6% (95% CI 60.4-70.5) and 94.4% (95% CI 89.3-97.6). CXR + ACT had specificities for all thoracic injury and for major thoracic injury of 99.7% (95% CI 98.2-99.9) and 80.7% (95% CI77.1-84.0).

**Conclusions:** Nexus chest CT-All has higher sensitivity to detect all thoracic injuries than CXR plus ACT. However, it seems that Nexus chest CT-Major has similar sensitivity to CXR plus ACT in detection of major thoracic injuries. The reductions of unnecessary TCT in major injury were 36.5% with Nexus CT-Major and 64.7% with CXR plus ACT. Therefore, Nexus chest CT and CXR plus ACT could be the option for the initial thoracic injuries evaluation in adult blunt trauma patients with GSC > 12.

### ENDOSCOPIC SUBMUCOSAL DISSECTION FOR EARLY GI CANCER USING ENDOSCOPY WITH FICE SYSTEM

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**Background:** Endoscopic Submucosal Dissection (ESD) has been proven to be effective procedure for therapeutic method for early gastrointestinal (GI) cancer due to able to obtain en-bloc resection.The study was aimed to investigate the lesions and outcomes of ESD cases in National Cancer Institute, Bangkok.

**Methods:** The retrospective study was carried out from November 2015 to May 2018 to include 16 patients, who underwent ESD for GI neoplasm at department of surgery, National Cancer Institute, Bangkok, Thailand. We investigated the following variables; patient characteristics, tumor location, tumor size, pathological and histological features, recurrence and short term survival outcome.

**Results:** From 16 ESD cases, 3 cases were diagnosed of early stage esophageal, gastric and colonic cancer. Short-term outcomes showed no tumor recurrence and distant metastasis 3 year. One patient with early gastric cancer underwent laparoscopic gastric surgery due to unfavorable margin.

**Conclusion:** Endoscopic Submucosal Dissection is safe and provides favorable outcome for early GI cancers.

## IN PATIENTS UNDERGOING ARTERIOVENOUS ACCESS CREATION, PATIENTS WITH HISTORY OF PREVIOUS CENTRAL VEIN CANNULATION HAD LOWER QUALITY OF LIFE THAN THOSE WITHOUT IN 9 MONTHS FOLLOW UP

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**Background:** Based on the K-DOQI guideline, arteriovenous access (AVA) creation in patients with end staged renal disease without prior hemodialysis through central line during moderate chronic kidney disease (CKD) stage is an ideal condition. But in our real life practice, most patients had experience central venous catheter (CVC) beforehand. Patients and physicians might not agree with that guideline, so they would prefer to delay AVA creation only during extremely severe CKD stage when patients need emergency CVC insertion.

**Objectives:** This study aimed to evaluate quality of life, AVA maturation and complication in patient after AVA creation between patients with and without history of CVC cannulation. The result might support or against with K-DOQI guideline.

**Methods:** This study compared the maturation rate, AVA stenosis, quality of life (SF-36) and complication of AVA in patients undergoing AVA creation between patients without any history of CVC (group A) and patients with history of CVC (group B). We compared these parameters at 3, 6, and 9 months follow-up. This study was supported by Health Systems Research Institute of Thailand

**Results:** There were 100 patients in group A and 101 patients in group B. Comparing with patients in group B in 3, 6 and 9 months follow-up, group A did not have any significantly difference in maturation rate and AVA stenosis rate. However, the AVA complication rate seems to be lower in group A than those in group B ($P$=0.10) The AVA complication rate of group A in 3, 6and 9 months were 3.0, 8.7 and 10.9% respectively, whereas those of group B were 8.9, 12.5 and 14.5% respectively. The quality of life (SF-36) in several parts namely health transition item, body pain, general heath perceptions and social functioning were significantly increased in group A than those in group B.

**Conclusion:** The ESRD patients undergoing AVA with or without central vein cannulation did not have any significant difference in major outcome in the first 9-month follow-up but the quality of life seems to be better in patients without CVC before AVA creation. More data and longer follow up is needed before any solid conclusion can be drawn.

## LONG-TERM ONCOLOGICAL OUTCOME OF MINIMAL INVASIVE SURGERY IN LOCALLY ADVANCED GASTRIC CANCER PATIENTS: SINGLE SURGEON'S EXPERIENCE AT NCI, THAILAND

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**Background:** Radical Gastrectomy with D2 lymph node dissection has accepted as the standard surgical procedure for most patients with operable gastric cancer (GC). Even after R0 resection, the long-term patients remain poor. Minimal invasive surgery (MIS) for advanced GC has become increasingly perform but the oncological outcome compare with conventional open surgery is in doubt. The enhanced surgical techniques and more experience surgeon may improve outcomes for patients with curatively resected gastrointestinal cancer.

**Objective:** To evaluate the role of MIS for advanced GC in terms of long-term oncological control and safety for the patients suitable for curative resection.

**Methods:** Twenty-eight gastric cancer patients with stage Ia-IIIc who underwent laparoscopic radical gastrectomy with curative intent in National cancer institute, Thailand between October 2010 and April 2018 by the same surgeon were retrospective studied. Clinicopathological features were analyzed. Peri-operative complications included those directly associated with surgery, such as hemorrhage, wound dehiscence, anastomotic leak, pancreatic fistula, lymphatic fistula and abdominal or wound infection.

**Results:** Neither postoperative mortality nor complications occurred in all patients. Seven in fourteen male patients (50%) were stage III diseases where as eleven in fourteen female patients (78.6%) were stage III. Tumor's greatest diameter were 0.8-7.5 cm, mean 4.2 cm with T4 in 10 cases (71.4%) in male patients whereas tumor in female patients were 1.5-10 cm, mean 5.6 cm (excluding Linitis Plastic case) with T4 in 10 cases (71.4%). Lymph node dissections in male patients yielded 8-61 nodes (mean 29)

with metastasis 0-25 nodes (mean 4.5 or N2) and in female patients were 15-61 nodes (mean 31) with metastasis 0-36 nodes (mean 11.9 or N3). Up to April 2018, 13 of 28 patients (7 males/6 females) still survive with relapse-free in 12 cases (6 males/6 females), 3 of them (1 male/2 female ) had disease free survival more than 5 years.

**Conclusion:** As feasibility and safety shown by getting 5-years survival rate (5-YSR) and the overall survival rate (OSR) without morbidity and mortality in the series suggest two important factors, the enhanced surgical technique as MIS and the experience surgeon play role.

## NOVEL TECHNIQUE OF OPEN TRANSVESICAL EXCISION OF OBSTRUCTIVE URETEROVESICAL JUNCTION AND DIRECT URETERIC RE-IMPLANTATION

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**Background:** Management of Primary Obstructive Megaureter (POM) is a dilemma faced by paediatric surgeons. Surgical management options for patients under 1 year old varies from endo-ureterectomy, cutaneous ureterostomy and refluxing ureteral reimplantation. Classical ureteric reimplantation can be very challenging due to the size discrepancy between grossly dilated ureter and small bladder. Modified ureteral orthotopic reimplantation is proposed by Wei Liu et al as one technique of refluxing reimplantation. This technique consists of transecting the ureter proximal to the obstruction and performing orthotopic reimplantation, with distal ureter freely protruding into the bladder.

**Case presentation:** Our patient was born term with antenatally diagnosed varicella zoster infection at 11 weeks' gestation. Detailed scan done at 19 weeks' gestation was unremarkable. Patient was initially well till day 5 of life where he developed sudden onsetrespiratory distress, metabolic acidosis, generalize doedema and decreased urine output. Biochemistry revealed rising urea, hyperkalemia and hyponatremia. Ultrasound showed small echogenic right kidney with multiple non-communicating cyst suggestive of multicystic dysplastic kidney and a moderately hydronephrotic left kidney with hydroureter along its entire length. Micturating cystourethrogram showed no reflux. Serum creatinine was high requiring peritoneal dialysis and a left nephrostomy was inserted as a bridging measure.A decision was later made for open left ureteric reimplantation using the modified ureteral orthotopic reimplantation technique described above. Open transvesical approach was used to dissect the left ureterovesical junction then 4.5 cm segment of the narrowed distal ureter was transected. The distal transected end of ureter was then mobilised allowing for an intentional 0.5 cm protrusion into the bladder prior to anchoring to bladder mucosa. Postoperative review at 6 weeks showed complete resolution of left sided hydronephrosis on ultrasound and serum creatinine had normalised.

**Conclusion:** Open intravesical orthotopic direct re-implantation in infancy is a good surgical option for management of primary obstructive megaureter.

## OCCULT INJURY IN GERIATRIC PATIENTS WITH FALL FROM OWN HEIGHT: DETECTION WITH PAN-SCAN SCREENING

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**Background:** The routine use of PAN-SCAN might be useful in patients with high-energy mechanisms of injury. However, it was unclear whether this screening tool would be beneficial in patients with low-energy mechanisms such as fall from own height (FFOH).

**Objectives:** To determine the proportion of occult injury from the initial examination for evaluating the usefulness of PAN-SCAN screening in geriatric patients with FFOH.

**Method:** A retrospective analysis of the trauma registry at the Montreal General Hospital, level I trauma center, from April 1st, 2014, to March 31st, 2016 was performed. We enrolled patients using the following inclusion criteria; age more than 65 years, admitted with FFOH and received PAN-SCAN. Primary outcomes were any head, neck or torso injuries detected by initial examination compared with PAN-SCAN. Secondary outcome was incidental finding from PAN-SCAN.

**Result:** A total of 130 patients enrolled into the study. The median age was 83 years. 50% were male. Their injury severity score was 11. The most common injury was thoracic injury and the second was head injury. 23.8% required surgical intervention or other procedures. Mortality rate was 15.4%. The use of initial examination revealed occult injuries, mostly occurred in thoracic (4.5%) and head (3.8%). All of patients with occult injury did not require surgical intervention or other procedures except one patient with occult head injury who required surgery.

57.7% of all patients had incidental findings. The most incidental findings were gallstones and benign liver cyst or mass. 6 patients (4.6%) were found malignant tumor and required surgery.

**Conclusions:** Although most additional injuries detected by PAN-SCAN did not require surgical intervention or other procedures, they required admission, closely monitor and intensive follow-up. Moreover, PAN-SCAN provides a benefit by diagnosing incidental non-trauma associated medical diseases which some required urgent therapy. Therefore, routine PAN-SCAN might be useful in geriatric patients with FFOH until better clinical decision rules are available.

## THE EARLY OUTCOMES OF HEPATECTOMY FOR HEPATOBILIARY CANCERS IN SAKONNAKHON HOSPITAL

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**Background:** Sakon Nakhon Hospital is a novice referral hepatobiliary center in the Northeast of Thailand. Hepatectomy is a curative treatment for hepatobiliary cancers. Nevertheless, the operation carries significant rate of mortality and complications; especially, from blood loss, posthepatectomy liver failure, and anastomosis bile leakage.

**Objectives:** To gather information of early outcomes of hepatic resections in Sakon Nakhon Hospital.

**Materials and Methods:** Descriptive retrospective data were collected from medical records of 54 hepatic resections performed during August 2015 - October 2017 at Sakon Nakhon Hospital. Outcome measures included demographic data, diagnoses, morbidity, mortality rates, intra-operative blood loss, and intra-operative blood transfusion.

**Results:** Hepatic resections with curative intent were performed in 54 patients, there were 27 males and 27 females with the mean age of 55 years (41-88 years). The histopathology findings were cholangiocarcinoma in 28 cases (51.9%), hepatoma in 12 cases (22.2%), colorectal liver metastasis in 9 cases (16.7%), and carcinoma of gallbladder in 5 cases (9.3%). Liver resection included 5 right extended hepatic resections (9.3%), 17 right hepatic resections (31.5%), 7 left hepatic resections (13%), 1 right anterior sectionectomy (1.9%), 6 left lateral segment resections (11.1%), 2 right posterior sector resections (3.7%), and 16 resections of hepatic segments (29.6%). Perioperative mortality occurred in 2 cases (3.7%), the cause of death in these patients was post hepatectomy liver failure. There were 29 procedural related complications (48.1%). Complications were bile leakage in 12 cases (22.2%), post hepatectomy liver failure in 6 cases (11.1%), acute kidney injury in 4 cases (7.4%), bleeding in 2 cases (3.7%), superficial surgical site infection in 2 cases (3.7%), pulmonary embolism in 1 case (1.9%), portal vein thrombosis 1 case (1.9%), and pleural effusion in 1 case (1.9%).

**Conclusions:** Hepatectomy for hepatobiliary malignancies at Sakon Nakhon Hospital has acceptable motality rate. However, morbidity rate is high in comparison with previous studies. Nevertheless the majority of complications could be managed with non-operative treatments.

# RESIDENT CONTEST AWARD

## 3D BURN RESUSCITATION MOBILE APPLICATION: A MORE PRECISE AND EASIER TOOL TO CALCULATE BURN SURFACE AREA

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**Introduction:** Burn area calculation is essential for estimation of severity and assessment of fluid resuscitation in burn patients. Inadequate or over resuscitation can lead to increasing morbidity and mortality in burn patients. A 3D Burn resuscitation mobile application has been developed to make it more precise and easier to calculate the burn surface area for physicians who are not burn specialists. The aim of our study is to validate the precision of burn surface area calculation using this application and other conventional methods both by physicians who are not burn specialists and burn specialists themselves.

**Method:** A prospective study was performed in burn patients from January 2017 to January 2018 at 3 burn

centers in Thailand including King Chulalongkorn Memorial hospital (KCMH), Chonburi hospital (CBH), and Chiangmai University hospital (CMH). Burn surface area was calculated by emergency physicians (EP) using both Rule of nine method and 3D Burn resuscitation mobile application. After all patients were admitted to each burn center both Lund and Browder chart (LB) and 3D Burn resuscitation mobile application were used to re-calculated the burn surface area of each patients by burn specialist. All data were analyzed using SPSS version 23.0.

**Results:** Overall 53 patients were recruited in this study, 18 in KCMH, 23 in CBH, and 12 in CMH. Mean age of patients was 42.5(17-94) years old. Sixty-eight percent were male patients (36/53). Burn surface area calculated by EP using Rule of nine method was significantly different from burn surface area calculated by the application using by same physicians ($p$<0.01). Burn surface area calculated by this application was not significantly different when using by EP or burn specialist ($p$= 0.54).

**Conclusion:** 3D Burn resuscitation mobile application is a more precise and easier tool to calculate the burn surface area for physicians who are not burn specialists comparing to Rule of Nine method. There is no difference in burn surface area calculating using this application between EP and burn specialist.

## A 15-YEAR CURE RATE FOLLOWING PARATHYROIDECTOMY IN PATIENTS DIAGNOSED WITH PRIMARY HYPERPARATHYROIDISM IN SONGKLANAGARIND HOSPITAL

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**Background:** Primary hyperparathyroidism demonstrates as a rare condition in Thailand. Under-diagnosis and delayed detection are major causes. Parathyroidectomy is a definitive treatment. However, cure rate, complications and factor-related complications remain unknown.

**Objectives:** We aimed to evaluate the cure rate following parathyroidectomy and identify factors associated with recurrent hyperparathyroidism. We also aimed to establish the guideline for screening primary hyperparathyroidism and routine follow-up following parathyroidectomy.

**Methods:** A cross-sectional study and retrospective cohort review identified 54 patients with primary hyperparathyroidism who underwent parathyroidectomy from January 2002 to December 2016 in Songklanagarind hospital. The demographic data, clinical features, laboratory and investigations, preoperative localizations, operative procedures, postoperative complications, pathological reports, and cure rate following parathyroidectomy were collected and analyzed.

**Results:** The median age at diagnosis was 55 years (range 46.5-67). Twenty-six patients presented with skeletal symptoms (48%). The most common pathology was parathyroid adenoma (75%). Most of cases (80%) used US neck and 99 mTc-sestamibi scan as preoperative localization. The median follow-up time was 50 months. The cure rate following parathyroidectomy was 96%. All of recurrent diseases were parathyroid carcinoma.

The parathyroid hormone (PTH), corrected calcium and alkaline phosphatase were decrease after parathyroidectomy while serum creatinine and blood pressure were not change from baseline. Hungry bone syndrome (24%) was the most common postoperative complication. Factors associated with hungry bone syndrome included ( 74% dropped of intraoperative PTH (IOPTH) (sensitivity 86%, specificity 63%), ALP ( 338 U/L (sensitivity 66%, specificity 93%) and baseline PTH ( 262 ng/ml (sensitivity 85%, specificity 60%).

**Conclusions:** High cure rate following parathyroidectomy highlights the important of early detection and identifying patients with primary hyperparathyroidism in Thailand. Those with hypercalcemia and skeletal symptoms should be checked PTH level for screening. The cut point of PTH and ALP for indicating postoperative complications may not reliable due to small number of patients. Larger studies are required.

## BACTERIAL STUDY OF BURN BLISTER FLUID AT MAHARAJ NAKORN CHIANG MAI HOSPITAL, A PROSPECTIVE COHORT STUDY

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**Background:** Burn blisters occurred partial-thicknessburn from mechanism that increased capillary permeability leading to edema formation between epidermis and dermis. Blister fluid contains substance from inflammatory process that impaired Pseudomonas,

auruginosa opsonization and suppressed blastogenic response, also low levels of immunoglobulins. All factors inhibit wound healing burn infection depend on microbacterial factors such as type and number of organism, toxin and enzyme production. A very few study about burn blister fluid. There was study from Wu that show the positive culture in burn blister fluid 16.4%.

**Objectives:** Incident of patient with culture positive from burn blister fluid in Maharaj Nakorn Chiang Mai Hospital and to find the predictive factors of culture positive-burn blister

**Methods:** 30 patients visited Maharaj Nakorn Chiang Mai Hospital with unbroken burn blisters among August 2017 to November 2017. The patients and burn wound characteristic were collected. Burn Blister fluid was obtained by meticulous sterile technique was performed in each case.Burn blister fluid was cultured on blood agar plates for at least 48 hrs.

**Results:** Of the 30 patients, mean age of the patients was 30.6 years (range 1 to 86 years), the mean time from injury to aspiration was 29.4 hrs. (range from 0.5 to 218 hrs.), The mean of total body surface area of burn was 14.4% (range from 0.5 to 45.73%) 6 (20%) showed positive culture results for bacterial microorganisms. Coagulase-negative Staphylococcus was the most common isolated microorganism, accounted for 83.3%. Scald burn was the most common cause in culture positive patients (66.6%). There was no statistically significant prognostic factor for burn blister infection found.

**Conclusion:** Unbroken blister fluid was positive for bacterial culture in 6 patients (20%). The microorganism isolated from culture included gram positive culture positive and gram negative bacteria without anaerobic bacteria. The prognostic factors correlated to positive culture result cannot be demonstrated. This study suggested that the culture from burn blister fluid should be done immediately in patient with burn blister fluid to define the sterilization of the burn wound.

## CHARACTERISTIC OF WELLS SCORE AND ASSOCIATED FACTORS OF ACUTE PULMONARY EMBOLISM IN SURGICAL-BASED INPATIENTS WITH ACUTE DVT

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**Background:** Wells score is not only a popular tool that effectively predicted acute deep vein thrombosis (DVT), but also simple for real practices. However, Wells score has not yet been proved to be used safely and effectively for inpatient setting (IPD).

**Objectives:** To evaluate the characteristic of Wells score and associated factors of acute pulmonary embolism (PE) in surgical-base in patients with acute DVT of Songklanagarind hospital.

**Material and Methods:** Acute DVT inpatients in departments of surgery, obstetrics-gynecology, and orthopedics from 2010 to 2016 were extracted from medical record and retrospectively reviewed. The Wells score was calculated for risk stratification in terms of low, moderate, and high probability. Inpatients with each risk probability were analyzed to evaluate their quantity. Finally, the associated factors of acute PE were assessed.

**Result:** There were 278 inpatients diagnosed acute DVT during hospitalization in surgery (n=142), obstetrics-gynecology (n=101), and orthopedics (n=35) wards. The numbers of imaging-confirmed acute DVT patients with a low risk probability were 3 (2.1%), 1 (1%), and 0 (0%) respectively (P=0.792). The number of moderate risk probability were 70 (49.3%), 53 (52.5%), and 18 (51.4%), respectively (P=0.884). The number of high risk probability were 69 (48.6%), 47 (46.5%), and 17 (48.6%), respectively (P=0.947). We identified factors that significantly different between the three specialties. The first one was patients who had paralysis, paresis, or recent plaster immobilization of the lower extremities (P<0.001). Second was patients who were recently bedridden or underwent a major surgical procedure (P<0.001). Third and fourth were patients who had leg edema and active cancer, respectively (P<0.001). Regarding the surgery service, the patients with acute PE experienced higher rate of acute bilateral DVT than patients who did not have 28% and 8%, respectively (P=0.025).

**Conclusions:** The low-risk probability determined by Wells score may be used to differentiate the presence of acute DVT in IPD setting. The acute bilateral DVT was more significantly associated with acute PE in the surgery service.

## COMPARISON BETWEEN THE EFFICACY OF 5% IMIQUIMOD CREAM AND INTRALESIONAL TRIAMCINOLONE ACETONIDE IN THE PREVENTION OF RECURRENCE OF EXCISED KELOID: A PROSPECTIVE RANDOMIZED STUDY

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**Background:** Keloid scars represented an abnormal,

exaggerated healing response after skin injury. In addition to cosmetic concern, scars may cause pain, pruritus, contractures. Nowadays, topical therapies have become increasing because they are easy to use, comfortable and non-invasive. The 5%imiquimod cream has been reported the effectiveness to prevent the recurrence rate of keloid after surgical excision.

**Objective:** This study was designed to evaluate the efficacy of 5% imiquimod cream in decreasing the recurrence rate of keloid after surgical excision, when compared with triamcinolone acetonide injection.

**Study design:** A prospective-randomized study was conducted by thirty patients enrolled. Fifteen patients were informed to applied 5% imiquimod cream nightly every other day for 12 weeks and fifteen patients were informed to use triamcinolone injection (standard treatment) after ear keloid excision and stitches removed.

**Result:** Thirty patients was examined of recurrence of keloid on their ears for 48 weeks after surgical excision, composed of male and female about 6.67% and 93.33%, respectively. The overall mean of Vancouver scar score for evaluating the effectiveness of imiquimod to decrease recurrence rate when compared with triamcinolone acetonide injection shown 4.72 and 5.23, respectively. However, the two methods were not statistically significant (*p*-value, 0.389). No serious local and systemic adverse event was detected in both groups of patients.

**Conclusion:** Treatment of surgical excision keloids with triamcinolone acetonide injection might be considered more than imiquimod cream for effectiveness in terms of decreased recurrence rate and higher patient satisfaction. The other limitation of this study is the number of the patients.

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## COMPARISON OF POSTOPERATIVE PAIN AT UMBILICAL WOUND AFTER CONVENTIONAL LAPAROSCOPIC CHOLECYSTECTOMYWITH TRANSUMBILICAL VERSUS INFRAUMBILICAL INCISIONS; A RANDOMIZED CONTROL TRIAL

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**Background:** Transumbilical incision of laparoscopic cholecystectomy has been widely performed to improve cosmetic outcome. The effect of transumbilical incision to postoperative pain compared with conventional infraumbilical incision is still lacking.

**Objectives:** Primary outcome is postoperative pain at 6, 24 hours, and 7 days after operation by using visual analog score (VAS). Secondary outcomes were analgesic used, length of stay, superficial surgical site infection (SSI), wound numbness, and hypersensitivity.

**Methods:** A randomized controlled trial was conducted at Thammasat University Hospital. Patients whom underwent conventional laparoscopic cholecystectomy (LC) were randomized to transumbilical or infraumbilical incisions. Patients' characteristics and outcomes were compared between interventional groups. Risk ratio, mean difference (MD), or median differences along with their 95% confidence interval (CI) were reported.

**Results:** In total, 102 patients were enrolled in which 51 patients were random to each of Interventional groups. Postoperative pain was similar between groups of interventions (MD-0.07 (95% CI: -0.47, 0.35)). Paracetamol usage was significantly less after transumbilical incision (MD -1 tab (95% CI: -1 (-1.9, -0.1)). However, the different lost its significant after adjusted for unbalanced characteristics. Other secondary outcomes were not statistically significantly different between groups. However, there was higher proportion of superficial SSI in transumbilical group (8 (16%)) vs 2 (4%) in infraumbilical groups ($p = 0.070$). Patients in both group were mostly very satisfied the cosmetic outcomes at 3 months.

**Conclusions:** Transumbilical incision had similar pain compared to infraumbilical incision. Most patients in both groups satisfied the operation at 3 months.

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## COMPARISON OF TRADITIONAL ELECTROSURGERY SYSTEM VERSUS LOW THERMAL TISSUE DISSECTION SYSTEM FOR TOTAL MASTECTOMY: A PROSPECTIVE RANDOMIZED CONTROLLED TRIAL

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**Background:** Various novel surgical equipment has

been used in breast surgery to reduce the post-operative seroma, however, real benefit from previous studies were controversial.

**Objectives:** This study was conducted to compare benefit of low thermal dissection system (PEAK Plasmablade®; PB) and traditional electrosurgery system (TE) in terms of seroma volume after mastectomy.

**Methods:** A prospective randomized controlled trial was designed. Patients who underwent mastectomy at a tertiary hospital from March 2017 to December 2017 were randomized into two arms; PB vs TE (n=25 each). Post-operative seroma, duration of tube drain insertion, hospital stay, pain score, blood loss and number of aspiration attempts were recorded and analyzed using two-tail independent t-test.

**Results:** All patients received mastectomy with or without axillary surgery. Both groups showed similar patient characteristics in terms of age, BMI and breast weight. There were no statistically significant difference of drainage volume (Mean PB = 862 cc and Mean TE = 759.84 cc, $p$=0.621). The hospital stay, estimated blood loss, pain score, duration of tube drain insertion also demonstrated no statistical significance in both groups.

**Conclusion:** When perform mastectomy in women with small breast volume, the benefit of low thermal dissection was not found over the traditional electrosurgery.

**Conflict of interest:** PEAK Plasmablade® used in this study was supported by Medtronic co., Ltd.

## DEVELOPMENT AND VALIDATION OF A NOVEL SMARTPHONE-BASED WOUND MEASUREMENT SYSTEM: SILPA RAMA WOUND ANALYZER

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**Background:** Wound area measurement is an important aspect in wound evaluation. Ideally wound measurement system should be accurate, unbiased, and useable for any operator, cost and time efficient. Silpa Rama Wound Analyzer (SRWA) is a novel android based digital planimetric application using smart phone and stylus. VISITRAK® is the conventional acetate tracing with digital planimetric system accepted in many clinical wound studies

**Objective:** To study the accuracy and reliability of SRWA compared with VISITRAK® system

**Methods:** In phase one accuracy and inter-rater variability of the VISITRAK(r) were analyzed. Three non-geometric computer-generated wound template (2, 8, 15 $cm^2$) were measured by forty five raters include surgical residents, nurses and medical students using SRWA and VISITRAK®. In phase two, intra-rater reliability of SRWA was studied. The same wound template were measured by four surgical residents using the SRWA.Percentage of Accuracy was calculated from relative errors, while inter- and intrarater reliability were evaluated using interclass correlation.

**Results:** In phase I, The percentage of accuracy of VISITRAK® in measuring the 2,8,15 $cm^2$ wound 96%, 99.5% and 98.9% respectively while SRWA's percentage of accuracy in measuring the 2,8,15 cm2 wound 77%, 79% and 79% respectively. The interclass correlation coefficient (ICC) of VISITRAK® was 0.997 (95% CI=0.988-1.000) while the ICC of SRWA was 0.998 (95% CI=0.992-1.000). The convenience score of VISITRAK® and SRWA were $7.533 \pm 1.455$ and $7.289 \pm 1.660$, which was not significantly different (p=0.508). In phase 2, the percentage of accuracy of the 2,8,15 $cm^2$ wound in curve surface was 77%, 76% and 75% respectively. The percentage of accuracy of the 2,8,15 $cm^2$ wound in planar was 64%, 64% and 68% respectively. The overall percentage of accuracy was 70.6%. The reliability test for SRWA show high interclass correlation (ICC=0.09) in for both intrarater and interrater measurements.

**Conclusions:** Silpa RamaWound Analyzer has excellent intrarater and interrater reliability. Although the accuracy was fair, the distribution of the measured value was narrow. With the current trend of smartphone usage, SRWA would provide objective assessment useable for raters who have different wound measurement skill that would ultimately improve the clinical wound care.

## EFFECT OF NORMOBARIC OXYGEN THERAPY ON WOUND HEALING IN PATIENTS WITH MINOR TISSUE LOSS FROM CRITICAL LIMB ISCHEMIA: A RANDOMIZED CLINICAL TRIAL

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**Introduction:** The objective of this study is to evaluate the effect of normobaric oxygen therapy on wound healing

in patients who presented with minor tissue loss from critical limb ischemia.

**Methods:** This randomized controlled trial was conducted at Ramathibodi Hospital. From May 2017 to January 2018, critical limb ischemia patients with minor tissue loss were randomly assigned to be treated with or without normobaric oxygen therapy for four weeks. The primary outcome is to evaluate the wound healing by measuring the wound surface area. The secondary outcome is to evaluate the change in the transcutaneous oxygen tension at pre- and post-treatment and also complications from the treatment.

**Result:** We assigned 28 patients with minor tissue loss into two group (after excluding one patient from each group due to infection) : 14 patients each group. The wound surface area at four-week times was smaller in intervention group (-0.06 ± 1.25 $cm^2$) but was larger in control group (0.825 ± 1.10 $cm^2$) without statistical significance ($p$=0.057). Likewise, the transcutaneous oxygen tension in the intervention group showed superior result compared to the control group (3.22 ± 9.54 vs -3.02 ± 7.25 mmHg) though there was no statistical significance ($p$ = 0.059).

**Conclusion:** Normobaric oxygen therapy may be beneficial for increasing wound healing in the critical limb ischemia patients who presented with minor tissue loss.

## EFFECTIVENESS OF SUBCUTANEOUS DRAIN TO PREVENT INCISIONAL SURGICAL SITE INFECTION AFTER ABDOMINAL SURGERY: A RANDOMIZED CONTROLLED TRIAL

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**Background:** Surgical site infection (SSI) is a common complication after abdominal operation which may cause disability or mortality. One of the factors associated with SSI was the abdominal wall thickness ≥ 20 mm. Therefore, the drainage of collection within subcutaneous tissue may decrease SSI rate.

**Objectives:** To compare SSI rate between patients with and without subcutaneous drain placement.

**Materials & Methods:** This study was prospective randomized controlled trial which included patients who had abdominal wall thickness ≥ 20 mm. and underwent major abdominal operation during October 2015 to January 2018. The enrolled patients were randomized into 2 groups; with and without subcutaneous drain. Demographic data, operative details, characteristics of wound and SSI rate were collected. The statistical tests were chi-square test for categorical data and t-test for numerical data.

**Results:** For 142 enrolled patients, 11 patients were excluded (4 from death during follow-up and 7 from incomplete data). Therefore, 58 patients were in group with drain and 73 patients without drain. The demographic data, operative time, subcutaneous thickness and length of incision were not different. Regarding SSI, there was no significant difference between both groups (29.3% and 23.3%, $p$ = 0.44). Subgroup analysis showed significantly lower incidence of deep SSI in group with drain when subcutaneous thickness ≥ 25 mm.(18.8% and 53.8%, $p$ = 0.04) and estimated cut surface area ≥ 4,500 $mm^2$ (8.3% and 50.0%, $p$ = 0.03).

**Conclusion:** Subcutaneous drain placement decreases deep SSI rate in patients with thicker abdominal wall or larger cut surface area of surgical wound.

## LAPAROSCOPIC SLEEVE GASTRECTOMY OUTCOMES: WHAT WE HAVE LEARNED?

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**Background:** Laparoscopic sleeve gastrectomy (LSG) is recently becoming one of the most commonly performed bariatric procedures worldwide. The efficacy of this procedure and also predictors for success should be determined.

**Objectives:** To evaluate outcomes of LSG on the adequacy of postoperative weight loss, incidence of weight-regaining after the initial success and to determine predictors that may relate to the success of the procedure.

**Methods:** A retrospective study was carried on all of morbidly obese patients who underwent LSG in King Chulalongkorn Memorial Hospital (KCMH) before May 2015. All the patients were followed-up for at least 3 years after the procedure to determine the rate of weight regaining. The bariatric outcomes were focused include the percent of excess weight loss (%EWL) within 18 months and after and weight regaining pattern after 18 months. The postoperative complications related to the procedure

were also observed both early and late complication. Preoperative factors in both inadequate weight loss (IWL) and weight regain (WR) group were analyzed to determine predictive factors related to the success of the procedure.

**Results:** There are 120 patients (55 female, 65 male) underwent LSG as primary bariatric procedure in KCMH before May 2015. 18-month follow-up data was available for 90 participants to define success of LSG at > 50% EWL, 59 patients (49.2%) succeeded to achieve this target with mean %EWL at 73.5 ( 17.39%, while 31 patients (25.8%) did not reach our goal, classified as IWL, with mean %EWL at 35.87 ( 10.6%. Overall mean %EWL at 18-month period was 57.19 ( 23.88% (Median 52.56). Among success group, there were 15 patients (25%) regained weight for more than 10 kg. The trend of weight regaining starts at 24 months after LSG. After 60 months follow-up, mean %EWL at was 58.72 ( 23.24% for success group and 4.03 ( 57.57% for IWL group. Overall mean %EWL at 60-month period was 46.83 ( 39.4% (Median 50.24%). There were 7 patients underwent additional laparoscopic Roux-en-Ygastric bypass, included six with inadequate weight loss and one due to weight regaining. Early postoperative complications included 3 patients with postoperative bleeding and one leakage. There was only one patient experienced functional obstruction as late complication and another one with incisional hernia.

**Conclusions:** LSG provides fairly good bariatric outcomes within medium-term follow-up period with low complication rate. However, higher preoperative BMI might relate to the chance of inadequate bariatric results. Long-term outcomes and predictors for success of this procedure should be clarified in further studies with larger number of patients.

## LAPAROSCOPIC TRANSPERITONEAL ADRENALECTOMY: A 10-YEAR SONGKLANAGARIND HOSPITAL EXPERIENCE

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**Background:** Laparoscopic adrenalectomy is currently the procedure of choice for removing benign, functioning or non-functioning, adrenal neoplasms. Various laparoscopic techniques and approaches have been reported using the transperitoneal or retroperitoneal approach.

**Objective:** The aim of this study is to present our 10-year experience with transperitoneal laparoscopic adrenalectomy and to confirm the feasibility and safety of the procedure.

**Methods:** The data were retrospectively collected from 107 patients who underwent laparoscopic adrenalectomy (LA) for benign adrenal neoplasms, between January 2006 and December 2016, in Songklanagarind hospital. LA was performed by a transperitoneal approach. Patients' demographic data, indication for surgery, operative time, blood loss, conversion rate, length of hospital stay, tumor size, and tumor pathology were collected and analyzed.

**Results:** A hundred and seven laparoscopic aderenalectomy were done. The patients were consisted of 23 men (22%) and 84 women (78%) with median age of 44 years (range 19-72). Most of the patients received treatment because of Conn's syndrome and adrenal cushing (64% and 21% respectively). Tumor located more frequently on the left side (58% vs 41%). Mean tumor size was 2.0 cm and mostly were cortical adenoma (82%). Overall mean operative time was 182 minutes and mean estimated blood loss was 68.42 mL with only 5% of the patients requiring blood transfusion. Conversion to open surgery was necessary in only 2 of 107 patients; both of them were diagnosed with pheochromocytoma. Mean length of hospital stay was 5 days. Rate of complications from intraoperative and postoperative were 9% and 5% respectively without mortality case. The length of hospital stay and operative time gradually decreased annually.

**Conclusion:** Laparoscopic transperitoneala drenalectomy appears to be safe, feasible, and effective procedure for benign adrenal neoplasms with low morbidity rate.

## PREDICTIONS FOR PLEURAL DECOMPRESSION IN TRAUMATIC OCCULTED HEMOTHORAX: A RETROSPECTIVE STUDY

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**Background:** Increasing of computed tomography using in trauma evaluation increased initially occult

hemothorax detection in blunt chest trauma. The proper management of this condition is still remaining controversial, should we drain it or not. This research aimed to study the overall factors determining pleural decompression.

**Methods:** Retrospectively reviewed all blunt chest injury patients from institutional trauma registry. Patients who received CT chest or whole abdomen within 24 hours were reviewed to identify occulted hemothorax which defined as initial negative CXR with presence of hemothorax in CT verified by a radiologist. Data collected included demographics, injury and characteristics of the hemothorax from the CT such as thickness of the hemothorax. The delayed complications and the treatments were also recorded.

**Results:** From 688 patients with blunt chest injury from 30 months of study, 81 (11.8%) of them had occult hemothorax. The mean time from injury to CT was 5.7 hours. Mostly were male (87.6%) suffered from traffic accident (70.2%) and had ribs fracture (84.4%). Pleural decompression was performed in 25 patients with significantly higher rate of occult pneumothorax (88% vs 53.8%, *p*-value < 0.01), lung contusion (44% vs 15%, *p*-value < 0.05) and thicker hemothorax (1.1cm vs 0.8 cm, *p*-value < 0.01). Multivariable logistic regression showed the thickness of hemothorax > 1.1 cm increased risk for needed of pleural decompression (OR 5.51, 95% CI 1.42 to 21.42) and also for occulted pneumothorax (OR 6.93, 95% CI 1.56 to 30.77).

**Conclusions:** Occult hemothorax occurs in a significant proportion of blunt chest trauma patients and pleural decompression was performed within conditions of concomitant occult pneumothorax, lung contusion and thicker hemothorax.

## SUPER-THIN EXTERNAL PUDENDAL ARTERY (STEPA) FLAP: CADAVERIC STUDY AND THE FIRST REPORTED CASE SERIES

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**Background:** Current the reconstruction using a free tissue transfer is very popular. However, there are limits to the thickness of the flap when reconstruction requires a thin and pliable flap, options have remained limited. The super thin external pudendal artery (STEPA) flap was introduced due to superiorly advantages such as its thinness (even in obese patients, as very little subcutaneous fat exists), reliable vascularity, constant pedicle anatomy, and its elasticity. Donor site can be closed primarily and donor scar is very well hidden. At present, there is only one published anatomical study, without application in the real patient. After the senior author performed this flap in real patients, we found several points which are different from the paper described. Therefore, important data are still lacking. In this study, we prospectively collect important measurements in cadavers and real cases done in our hospital.

**Methods:** The study was prospectively conducted in 12 male adult cadavers (6 fresh and 6 soft cadavers) and 6 patients who underwent for defect coverage with free scrotal flap in Ramathibodi hospital during September 2014 to December 2017. Inclusion criteria were Thai nationality, male aged over 15 years. Measurements were performed including distance from inguinal ligament to external pudendalartery (EPA), distance from inguinal ligament (IL) to saphenofemoral junction (SFJ), distance from SFJ to external pudendal vein (EPV), pedicle length of external pudendal artery and vein, diameter of external pudendal artery and vein. Anatomical variation of the course of EPA were observed and classified.

**Results:** The mean age was 59 years (range, 29 - 85 years). Mean distance from IL to EPA was 4.83 cm (range, 1.6 - 8 cm) , mean distance from IL to SFJ was 3.9 cm (range, 1.3 - 6 cm), mean distance from SFJ to EPV was 2.06 cm (range, 0.5 - 4 cm), mean pedicle length of EPA was 4.34 cm (range, 1 - 10.1 cm), mean pedicle length of EPV was 2.32 cm (range, 0.5 - 5.6 cm), mean diameter of EPA was 1.97 cm (range, 1.3 - 2.7 cm) and mean diameter of EPV was 2.29 cm. (range, 1 - 4 cm). From our findings, we classified two types of EPA anatomy based on its relationship with great saphenous vein as follow: Type A, external pudendal artery pass above great saphenous vein. Type B, external pudendal artery pass below great saphenous vein. EPV in all of our subjects drain into the great saphenous vein before it join femoral vein at SFJ.

**Conclusions:** When reconstruction requires a thin and pliable flap, STEPA free flap is an excellent alternative. Our anatomical study has demonstrated that the flap is super thin with a large surface area when fully stretched; the vessel diameters and length are more than sufficient for microsurgical transfer. Our case series also confirm that the STEPA flap is doable in variety of defect types. Moreover, the donor site can be closed primarily and the scar is very well hidden.

## VDO AWARD

### DIAGNOSIS AND TREATMENT OF ACHALASIA: HOW TO READ HIGH-RESOLUTION MANOMETRY LAPAROSCOPIC HELLER MYOTOMY WITH FUNDOPLICATION

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**Background:** Esophageal achalasia is a rare condition of the esophagus, affecting 1 in 100,000 individuals. It is a benign condition manifest by dysphagia, regurgitation, and chest pain and is characterized, manometrically, by a hypertensive nonrelaxing lower esophageal sphincter (LES). Aperistalsis or vigorous uncoordinated contractions of the esophageal body are associated manometric finding.

**Objectives:** This video details about 1) How to read high-resolution manometry and diagnosis of achalasia. 2) Evidence based and comparative of fundoplication after performing laparoscopic Heller myotomy. 3) Tips and tricks of laparoscopic Heller myotomy with fundoplication.

**Materials & Methods:** There are seven key steps: 1) Dissection of gastrohepatic ligament 2) Division of peritoneum and phrenoesophageal membrane above esophagus 3) Dissection of short gastric vessels 4) Initiation of myotomy 5) Proximal and distal extension of myotomy 6) Intraoperative upper endoscopy 7) Fundoplication.

**Results:** Laparoscopic Heller myotomy with fundoplication can be performed as the same standard as open exploration.

**Conclusion:** The video shows the technical feasibility of laparoscopic Heller myotomy with fundoplication for achalasia. Our experience and success is promising.

### LAPAROSCOPIC LATERAL PELVIC LYMPH NODE DISSECTION: HOW I DO IT?

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**Background:** Laparoscopic pelvic lymph node dissection (LPND) is indicated in low rectal cancer patient with clinical lateral pelvic lymph node metastasis. This procedure is usually performed in conventional open technique. LPND can be done laparoscopically with acceptable short term and long term oncologic outcome. This video present technique of laparoscopic LPND step by step and demonstrate the major landmark structure in laparoscopic view.

**Presentation of case:** A 46-years-old male was diagnosed with locally advanced rectal cancer with clinical lateral pelvic lymph node metastasis. The patient received neoadjuvant concurrent chemoradiotherapy then went for laparoscopic low anterior resection with therapeutic LPND. This procedure was successful and patient fully recovered and discharge 5 day after the operation. The operative step are medial dissection of the ureter, dissection the fibroareolar tissue away from the lateral border (common and external iliac vessel), identification obturator nerve and branch of internal iliac vessel, division of some anterior branch of internal iliac vessel and remove the fibroareolar tissue.

**Conclusion:** This video present technique for laparoscopic LPND and the important land mark in laparoscopic view. Anatomical knowledge of the important landmark and operative step makes this operation feasible.

### LAPAROSCOPIC ULTRA-LOW ANTERIOR RESECTION FOR LOW RECTAL CANCER: TIPS AND TRICKS INCLUDING DELOYERS PROCEDURE

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**Background:** The primary treatment for rectal cancer is still surgery. Surgery, however, may be either be preceded or followed by chemotherapy and radiotherapy when needed. Good surgery on its own when applied appropriately is associated with a very low rate of local recurrence. Bad surgery however, is associated with a high risk of local and systemic recurrence. The well-performed ultra-low anterior resection with total mesorectal clearance has been shown to be the most important step in the treatment of a low rectal cancer especially when perform with laparoscopic surgery.

**Objectives:** This video details the tip to make the performance of a laparoscopic ultra-low anterior resection easy.

**Materials & Methods:** There are eight key steps: 1) Dissection of left retroperitoneum, 2) High ligation of inferior mesenteric artery and inferior mesenteric vein, 3) Dissection of lateral part of left side colon 4) Take down splenic flexure 5) Dissection of upper mesorectum

6) Dissection of right and left mid mesorectum 7) Dissection of distal mesorectum and 8) Anastomosis. This video also shows Deloyers procedure as colon lengthening technique by using the right side colon to the anastomosis in a patient who has synchronous transverse colon cancer with low rectal cancer.

**Results:** Laparoscopic ultra-low anterior resection can be performed as the same standard as open exploration.

**Conclusion:** The video shows the technical feasibility of laparoscopic total mesorectal excision for low rectal cancer. Our experience and success is promising.

### LYMPHATICO-VENULAR ANASTOMOSES: TREATMENT FOR SECONDARY LYMPHEDEMA: A CASE REPORT

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**Background:** The lymphatico-venular anastomosis (LVA) is the one of physiologic surgical treatments for lymphedema. The effectiveness of treatment depends on type of lymphedema, number of anastomoses and post-operative rehabilitation.

**Objectives:** To demonstrate surgical technique of supra-microsurgery and outcomes after treatment of secondary lymphedema with LVA technique.

**Methods:** A case report of 64-year woman presented with right upper extremity lymphedema for 7 years after bilateral breast cancer treatment. The surgical procedure demonstrate of lymphatic vessels identification by indocyanine green and isosulfan blue dye injection (double technique), technique of suturing and outcomes after treatment.

**Results:** After treatment the patient improved of skin quality without any episode of lymphangitis and decreased maximal arm circumference 88.89% (pre-operative 46.3 cm vs post-operative 34.5 cm) and 66.67% for forearm (39 cm vs 35 cm, pre-operative and post-operative respectively) when compared to left arm (33 cm and 33 cm of arm and forearm respectively).

**Conclusion:** The LVA procedure is the effective treatment for secondary lymphedema.

## YOUNG INVESTIGATOR AWARD

### COST-EFFECTIVENESS EVALUATION OF BARIATRIC SURGERY FOR MORBIDLY OBESE WITH DIABETES PATIENTS IN THAILAND

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**Background:** Bariatric surgery is a choice for treatment in morbidly obese patients with type 2 Diabetes Mellitus (DMtype 2) who has inadequate diabetes control with only medical treatment. However, bariatric surgery requires highly sophisticated equipment thus the cost of surgery seems to be very high following the procedure compared with the cost of conventional diabetes care. This raises the question of whether bariatric surgery is cost-effective for morbidly obese people with diabetes in Thailand.

**Objective:** To perform a cost-effectiveness evaluation of bariatric surgery compared with ordinary treatment for diabetes control inmorbidly obese with DM type 2 patients in Thailand.

**Methods:** Cost-effectiveness study was conducted, using a combination of decision tree and Markov model in analysis. Treatment outcomes and healthcare costs incurred by data from literature review and retrospective cohort in King Chulalongkorn Memorial Hospital from September 2009 to March 2016 for conventional and bariatric surgery group respectively. One-way sensitivity was used for analysis the robustness of the model. Cost-effectiveness was assessed by calculated Incremental Cost-Effectiveness Ratios (ICERs). Monetary benefits at a threshold of 150,000 to 200,000 Thai baht (THB) per quality-adjusted life-year (QALY) based on Thailand Gross Domestic Products (GDP) value was regarded as cost-effectiveness of bariatric surgery.

**Results:** Bariatric surgery significantly improves clinical outcome including long-term diabetes remission rate, hemoglobin A1C, and Body Mass Index (BMI). The

incremental cost per QALY of bariatric surgery compared with medication control is 26,907.76 THB/QALY which can be considered bariatric surgery as a cost-effective option.

**Conclusions:** Use of bariatric surgery in morbidly obese with DM type 2patients is cost- effectiveness strategy in Thailand's context.

## ESTABLISHING THE LEARNING CURVE OF AN ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY TEAM: A CHALLENGE IN ESTABLISHING A COMPETENT TEAM AND EARLY OUTCOMES OF ERCP IN SAKON NAKHON HOSPITAL

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**Background:** Endoscopic retrograde cholangiopancreatography (ERCP) is a highly technical demanding procedure which needs competent operator. However, a competent operator is not the single factor of successful ERCP: teamwork between healthcare professionals during the ERCP procedure is also important.

**Objectives:** The objectives of this study are to analyze a team's learning curve for the ERCP procedure, and to gather information regarding successful cannulation rate and procedural-related complications for ERCP in Sakon Nakhon Hospital.

**Materials and Methods:** A retrospective study with data collection from the patients who were performed elective ERCP in Sakon Nakhon Hospital from August 2015 to July 2017, by a single experienced operator with a novice ERCP team. The team's learning curve was analyzed by plotting average cannulation time and average total operating time of a block of ten ERCPs in native papilla against the operation sequence. Data regarding successful cannulation rate in natural papilla and procedural related complications were gathered to evaluate team competency in ERCP.

**Results:** There were 222 elective ERCPs in the studied period; 175 ERCPs of these ERCPs were native papilla. Total successful cannulation rate in native papilla was 83.4%. Cannulation time and total operative time became steadier after 70$^{th}$ ERCPs. Successful cannulation rate in the last 15 ERCPs in the study was 93.3%. The procedural related complications were: pancreatitis in 27 ERCPs, cholangitis in 18 ERCPs, bleeding in two ERCPs, and perforation in one ERCP. There were eight procedural-related mortality cases; seven of them were cholangiocarcinoma cases, and one of them was a case of common bile duct stone.

**Conclusions:** It needed at least 70 ERCPs to establish an efficient ERCP team. The mortality rate of ERCP in this study was high due to high rate of post-ERCP cholangitis in cholangiocarcinoma patients.

## NOMOGRAM TO PREDICT NON-SENTINEL LYMPH NODE STATUS USING TOTAL TUMOR LOAD DETERMINED BY ONE-STEP NUCLEIC ACID AMPLIFICATION (OSNA)

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**Background:** Axillary dissection might be omitted in selected breast cancer patients. Total tumor load (TTL) in sentinel lymph node (SLN) expressed by cytokeratin 19 (CK19) mRNA, detected by automated molecular technique-one-step nucleic acid amplification (OSNA), can quantitativelydetermine tumor burden in SLN.

**Objective:** to create nomogram to predict non-sentinel lymph node (NSLN) status using OSNA technique.

**Patients and Methods:** Breast cancer patients were recruited at Division of Head Neck and Breast Surgery, Department of Surgery, Siriraj Hospital, Mahidol University, Thailand from November 2015 to January 2018. The patients with invasive breast cancer T1-T3, clinically negative axillary lymph node and able to give informed consent underwent SLN biopsy assessed by OSNA. The patients with positive SLN underwent axillary lymph node dissection. Correlations between TTL, clinicopathological parameters and NSLN status were analyzed by chi-square statistic and logistic regression. Model discrimination was evaluated using receiver-operating characteristic (ROC) analysis.

**Results:** Total number of the patients who underwent SLN biopsy was 262. There were 85 patients with positive SLN. Mean age at diagnosis of the patients in this group was 54.52 ± 11.66 years. NSLNs were positive in 37 patients. Larger tumor size (25.35 ± 9.02 mm vs 37.78 ± 16.88 mm) and presence of lymphovascular invasion (24.5% vs 67.6%) were the independent factor that predicts positive NSLN. TTL expressed by CK19 mRNA copy number can discriminate NSLN status with the area under ROC curve of 0.784 (95% CI 0.683-0.885). At the cut off level at 6550

copies/μL, sensitivity, specificity, and negative predictive value were 86.49%, 57.14%, and 84.85%, respectively. Nomogram containing tumor size and SLN status can predict NSLN involvement with area under ROC curve of 0.827 (95%CI 0.737-0.918).

**Conclusion:** Nomogram using the results by OSNA technique can predict NSLN status and help in decision for axillary lymph node dissection.

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