ปัจจัยเสี่ยงต่อการเกิดกลุ่มอาการตอบสนองต่อการอักเสบทั่วร่างกายตามหลังการผ่าตัดส่องกล้องชนิดโค้งงอสำหรับนิ่วในท่อไตส่วนบนและนิ่วในไตในโรงพยาบาลตรัง

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บทคัดย่อ

ปัจจัยเสี่ยงต่อการเกิดกลุ่มอาการตอบสนองต่อการอักเสบทั่วร่างกายตามหลังการผ่าตัดส่องกล้องชนิดโค้งงอสำหรับนิ่วในท่อไตส่วนบนและนิ่วในไตในโรงพยาบาลตรัง

วัตถุประสงค์

การผ่าตัดส่องกล้องชนิดโค้งงอสำหรับนิ่วในท่อไตส่วนบนและนิ่วในไตสามารถเกิดภาวะแทรกซ้อนได้หลายอย่าง การศึกษานี้ต้องการที่จะหาปัจจัยเสี่ยงของการเกิดกลุ่มอาการตอบสนองต่อการอักเสบทั่วร่างกายตามหลังการผ่าตัดส่องกล้องชนิดโค้งงอ

วิธีการศึกษา

การศึกษาแบบย้อนหลังเพื่อศึกษาผู้ป่วย 48 คนที่ได้รับการผ่าตัดส่องกล้องชนิดโค้งงอสำหรับนิ่วในท่อไตส่วนบนและนิ่วในไตระหว่างเดือนมกราคม พ.ศ.2563 ถึง เดือนกรกฎาคม พ.ศ.2566 ที่โรงพยาบาลตรัง ผู้ป่วยได้รับการดมยาสลบทั้งร่างกายด้วยวิธีใส่ท่อช่วยหายใจ ในท่าขึ้นขาหยั่งได้รับการผ่าตัดรักษาโดยแพทย์ทางเดินปัสสาวะคนเดียว ปัจจัยเสี่ยงก่อนและระหว่างการผ่าตัดถูกเก็บบันทึกเปรียบเทียบระหว่างผู้ป่วยที่พบกลุ่มอาการตอบสนองต่อการอักเสบทั่วร่างกาย และกลุ่มที่ไม่พบ

ผลการศึกษา

อุบัติการณ์ของการเกิดกลุ่มอาการตอบสนองต่อการอักเสบทั่วร่างกายตามหลังการผ่าตัดส่องกล้องชนิดโค้งงอสำหรับนิ่วในท่อไตส่วนบนและนิ่วในไตเป็น 47.9% ในการวิเคราะห์การทดสอบแบบตัวแปรเดียว พบว่า ดัชนีมวลกาย ≥25 kg/m2 , เวลาผ่าตัดที่ ≥ 90 นาที การเพาะเชื้อปัสสาวะก่อนผ่าตัดให้ผลบวก เป็นปัจจัยที่ส่งผลอย่างมีนัยสำคัญ (p=0.002 , p=0.021, p=0.000 ตามลำดับ) ซึ่งในการวิเคราะห์หลายตัวแปรยืนยันปัจจัยเสี่ยงทั้งสามปัจจัยเหล่านี้ (p=0.044,p=0.040,p=0.001 ตามลำดับ)

สรุป

ผู้ป่วยที่มีดัชนีมวลกาย ≥25 kg/m2 , เวลาผ่าตัดที่ ≥ 90 นาที หรือการเพาะเชื้อปัสสาวะก่อนผ่าตัดให้ผลบวกควรเฝ้าระวังกลุ่มอาการตอบสนองต่อการอักเสบทั่วร่างกายตามหลังการผ่าตัดส่องกล้องชนิดโค้งงอสำหรับนิ่วในท่อไตส่วนบนและนิ่วในไต

คำสำคัญ : กล้องส่องท่อไตชนิดโค้งงอ, นิ่วในไต, นิ่วในท่อไตส่วนบน, กลุ่มอาการตอบสนองต่อการอักเสบทั่วร่างกาย

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Risk factors of systemic inflammatory response syndrome following retrograde intrarenal surgery for renal and upper ureteric stones in Trang hospital, Thailand

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Abstract

Objective : Retrograde intrarenal surgery (RIRS) has many complications . This study aimed to evaluate the risk factors of systemic inflammatory response syndrome (SIRS) following retrograde intrarenal surgery.

Method : This study retrospectively analyzed 48 patients who underwent RIRS between January 2020 to July 2023 at Trang hospital. All RIRS were conducted with patients under general anesthesia in the low lithotomy position and performed by 1 urologist. Preoperative and intraoperative risk factors that potentially contribute to SIRS were compared in patients who developed postoperative SIRS and those who did not. Univariable (two way analysis of variance) and multivariable analysis (one way multivariate analysis of variance) was done. The level of significance was set at p-value <0.05.

Results : The incidence of SIRS following RIRS was 47.9% . In univariate test analysis, significant between SIRS and three factors was noted : BMI ≥25 kg/m2 , longer operative time ≥ 90 minutes and preoperative positive urine culture were likely to have SIRS (p=0.002 , p=0.021 , p=0.000 respectively). In multivariate analysis confirmed that BMI ≥25 kg/m2 , longer operative time ≥ 90 minutes and preoperative positive urine culture results (p=0.044,p=0.040,p=0.001 respectively) were significant risk factors of SIRS following RIRS procedure .

Conclusion : The patients with BMI ≥25 kg/m2 , operative time ≥ 90 minutes or preoperative positive urine culture resuts should be concerned about SIRS following RIRS procedure.

Keywords : Flexible ureterorenscope , renal calculi, upper ureter stones ,systemic inflammatory response syndrome

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Introduction

Retrograde intrarenal surgery (RIRS) using a flexible ureterorenoscope with holmium laser is one of the main method for stone removal . RIRS can access the collecting system without renal parenchymal injury. The success rate of RIRS is now improved with development of modern flexible ureterorenoscope and holmium laser. The bigger stone (more than 2 cm) was designed to treat with RIRS due to surgeon experience gaining[5], patient comorbidity and patient preference .The continuous development of flexible ureteroscopy , increasing flexibility ,smaller diameter ureteral access sheath had become the standard of ureteral and renal stones treatment.[9] But RIRS still has weakness , such as limited visual field , high cost for disposable flexible ureteroscopy and learning curve.[2]Common complications of RIRS are pain , hematuria , fever , sepsis and death. [12]

Objective

Retrograde intrarenal surgery (RIRS) has many complications . This study aimed to evaluate the risk factors of systemic inflammatory response syndrome (SIRS) following retrograde intrarenal surgery.

Hypotheses

Following retrograde intrarenal surgery for renal and upper ureteric stones, the patient features, underlying disease , stone burdens , and stone surgeries are associated with systemic inflammatory response syndrome.

Conceptual Framework

The researcher focus on systemic inflammatory response syndrome (SIRS) due to the finding of main complication in Trang hospital is SIRS . SIRS following RIRS is high about 47.9% (23/48). When our patients have SIRS which impact to our patients make them have long hospital stay ,late recovery time and high hospital cost.From previous studies the rate of infectious complication about 7.14-11.3%.[10] The risk factors are different .From many studies, the risk factors are are preoperative positive urine culture result , stone size >20 mm , extended operative time[13] and preoperative pyuria.[6] This study aimed to find the risk factors of systemic inflammatory response following retrograde intrarenal surgery in Trang hospital .

Method

RIRS was done by 1 surgeon .

Patient history , physical examination , preoperative laboratories included complete blood count , electrolyte , BUN , creatinine , urine exam , urine culture , chest X ray , Plain KUB was performed in all cases. The patients who had positive urine culture results received complete course of antibiotics before ongoing

operation.

Prophylactic antibiotics was given to all patients with ceftriaxone 2 gm intravenous 1 hour before operation . Ciprofloxacin 400 mg intravenous was given in cases of history of ceftriaxone allergy .

Double-j ureteral stents were retained in all patients .

Noncontrast helical CT was done in most cases (25/48). Imaging such as ultrasound KUB , Plain KUB was done in the remaining cases due to financial reasons.

Population and Sample

This study collected the data from 48 patients who underwent RIRS for kidney stones and ureteral stones between January 2020 to July 2023 at Trang hospital , Thailand .

Purposive Sampling – every patients met the criteria for RIRS , and there were no cases that weren't appropriate, like those that were too little (less than 4 mm), had unfavorable renal anatomy , or had current urinary tract infections.

Research instrument

All RIRS cases was performed under general anesthesia in the low lithotomy position.

The instruments included

- Semirigid ureterorenoscopy 8/9.8 Fr. (Richard Wolf, Knittlingen , Germany)
- 0.035 inch PTFE guide wire (Boston ,scientific USA)
- Flexible Ureteroscope 9.5Fr outer diameter - LithoVue™ Single-Use Digital (Boston ,scientific USA)
- JJ ureteral stent No.6Fr - Percuflex™ Plus Ureteral Stent (Boston ,scientific USA)
- Ureteral Access Sheath No.11/13 Fr - Navigator™ (Boston ,scientific USA)
- Holmium laser 35 watt (Quanta system litho evo ,Italy)
- Normal saline solution for intraoperative irrigation 80cm high.

Systemic inflammatory response syndrome (SIRS)

This study use Systemic inflammatory response syndrome (SIRS) as primary endpoint.

The patient data was collected within 2 weeks postoperatively . The patients who diagnosed SIRS needed to meet at least 2 of 4 criteria.[8]

1. body temperature >38°C or < 36°C
2. respiratory rate >20 breaths/minute or partial pressure of carbon dioxide <32 mmHg (<4.3 kPa), at least 12 hours after surgery
3. heart rate >90 beats/minute, at least 12 hours after surgery
4. leukocyte count >12,000 cells/mm3 or <4,000 cells/mm3

The patients who did not meet this criteria ,was classified as Non SIRS group.

Data collection

This research is retrospective study . The data was collected from medical record of 48 patients who underwent RIRS for kidney stones and ureteral stones between January 2020 to July 2023 at Trang hospital , Thailand .

Data Analysis

- IBM SPSS Statistic 23 (IBM , Armonk , NY , USA)
- Binary Logistic Regression.
- Univariable (two way analysis of variance) analysis for ages, gender, BMI, diabetes, stone sizes, operative time, positive preoperative urine culture results, history of urinary stone treatment, stone location and hydronephrosis Multivariable analysis (one way multivariate analysis of variance) for BMI, operative times and preoperative positive urine culture results
- The level of significance was set at p-value <0.05

Ethical Consideration/ Informed consent

The Ethics committee of Trang hospital ,Thailand approved this study (ID 043/08-2566).Informed consent was performed . The patients was informed about risk and benefit of this operation .

Result

The medical records of 48 patient were reviewed retrospectively. The patient characteristics was showed in table 1.

Table 1 : Clinical characteristics of patients

Characteristics		Total (N = 48)	Non-SIRS (N = 25)	SIRS (N = 23)
Age (years)		52.02 ± 13.79	54.44 ± 12.21	49.39 ± 15.15
Gender				
	male	27 (56.25)	16 (33.33)	11 (22.92)
	female	21 (43.75)	9 (18.75)	12 (25.00)
BMI		25.59 ± 4.87	23.62 ± 2.96	27.73 ± 5.66
	<25 kg/m^2	24 (50.00)	18 (37.50)	6(12.50)
	≥25 kg/m^2	24 (50.00)	7 (14.58)	17 (35.42)
Length of stay		3.63 ± 2.26	2.24 ± 0.60	5.13 ± 2.44
Stone size		1.97 ± 1.01	1.96 ± 1.06	1.99 ± 0.99
	< 2 cm	28 (58.33)	15 (31.25)	13 (27.08)
	≥ 2 cm	20 (41.67)	10 (20.83)	10 (20.83)
Operative time (minutes)		91.50 ± 28.92	81.72 ± 25.45	102.13 ± 29.21
	< 90 minutes	21 (43.75)	15 (31.25)	6 (12.50)
	≥ 90 minutes	27 (56.25)	10 (20.83)	17 (35.42)

Table 1 : Clinical characteristics of patients

Characteristics	Total (N = 48)	Non-SIRS (N = 25)	SIRS (N = 23)
Preoperative CT scan (HU)	829.00 ± 399.47	878.17 ± 377.13	783.62 ± 429.09
NO	23 (47.91)	13 (27.08)	10 (20.83)
< 1000 HU	15 (31.25)	7 (14.58)	8 (16.67)
≥ 1000 HU	10 (20.84)	5 (10.42)	5 (10.42)
Diabetes			
no	40 (83.33)	21 (43.75)	19 (39.58)
yes	8 (16.67)	4 (8.33)	4 (8.33)
Preoperative urine culture results			
E. Coli	13 (27.08)	0	13 (27.08)
Klebsiella Pneumoniae	3 (6.25)	0	3 (6.25)
E. Faecium	3 (6.25)	1 (2.08)	2 (4.17)
Pseudomonas Aeruginosa	1 (2.08)	0	1 (2.08)
Mixed	1 (2.08)	1 (2.08)	0
no growth	27 (56.25)	23 (47.92)	4 (8.33)
History of urinary stone treatment			
no	19 (39.58)	10 (20.83)	9 (18.75)
yes	29 (60.42)	15 (31.25)	14 (29.17)
Stone location			
kidney	26 (54.17)	14 (29.17)	12 (25.00)
ureter	12 (25.00)	3 (6.25)	9 (18.75)
kidney and ureter	10 (20.83)	8 (16.67)	2 (4.17)
Hydronephrosis			
no	5 (10.42)	4 (8.33)	1 (2.08)
mild	23 (47.92)	12 (25.00)	11 (22.92)
moderate	18 (37.50)	8 (16.67)	10 (20.83)
severe	2 (4.16)	1 (2.08)	1 (2.08)

Data are shown as mean ± standard deviation or number of patients (%)

The mean patient age was 52.02 ± 13.79 years , 27 males (56.25 %) , 21 females (43.75 %). The mean BMI was 25.59 ± 4.87 . The incidence of SIRS was 47.9% (23/48). The mean stone diameter was 1.97 ± 1.01 cm. The mean operative time was 91.50 ± 28.92 min. Preoperative urine culture result showed positive results for 21 patients .

Univariate analysis revealed that patients with BMI ≥25 kg/m2 , longer operative time ≥ 90 minutes and preoperative positive urine culture were likely to have SIRS (p=0.002 , p=0.021 , p=0.000 respectively) (Table 2)

Table 2 : Univariate analysis

Variables	Non-SIRS	SIRS	OR	95% C.I.		p-value	
	n(%)	n(%)		Lower	Upper		
Age (years)	54.44 ± 12.21	49.39 ± 15.15	0.973	0932	1.015	0.206	
Gender (male/female)	16 (33.33)/ 9 (18.75)	11 (22.92)/ 12 (25.00)	1.939	0.61	6.162	0.261	
BMI ≥25 kg/m^2	7 (14.58)	17 (35.42)	7.286	2.034	26.102	0.002*	
Diabetes	4 (8.33)	4 (8.33)	1.105	0.242	5.046	0.897	
Stone size ≥ 2 cm	10 (20.83)	10 (20.83)	1.154	0.366	3.64	0.807	
Operative time ≥ 90 minutes	10 (20.83)	17 (35.42)	4.250	1.246	14.502	0.021*	
Positive preoperative urine culture results	2 (4.17)	19 (39.58)	54.625	9.004	331.408	0.000*	
History of urinary stone treatment	15 (31.25)	14 (29.27)	1.037	0.326	3.302	0.951	
Stone location (ureter)	3 (6.25)	9 (18.75)	3.500	0.768	15.958	0.106	Compare with kidney
Stone location (kidney and ureter)	8 (16.67)	2 (4.17)	0.292	0.052	1.646	0.163	Compare with kidney
Hydronephrosis (mild)	12 (25.00)	11 (22.92)	3.667	0.354	38.029	0.276	Compare with no
Hydronephrosis (moderate)	8 (16.67)	10 (20.83)	5.000	0.463	54.044	0.185	Compare with no
Hydronephrosis (severe)	1 (2.08)	1 (2.08)	4.000	0.117	136.957	0.442	Compare with no

Table 2 : Univariate analysis

Variables	Non-SIRS	SIRS	OR	95% C.I.		p-value
	N(%)	N(%)		Lower	Upper	
Univariate analysis, Binary Logistic Regression, *p-value ≤ 0.05						
BMI (body mass index), SIRS (systemic inflammatory response syndrome)						

In multivariate analysis , Table 3 confirmed that BMI ≥25 kg/m^2 , longer operative time ≥ 90 minutes and preoperative positive urine culture(p=0.044,p=0.040,p=0.001 respectively) were significant risk factors of SIRS following RIRS procedure .

Table3. : Multivariate analysis

Variables	NON-SIRS n(%)	SIRS n(%)	p-value (univariate)	p-value (multivariate)	VIF
BMI ≥ 25 kg/m2	7 (14.58)	17 (35.42)	0.002	0.044	1.168
Operative time ≥ 90 minutes	9 (18.75)	17 (35.42)	0.021	0.040	1.036
Positive preoperative urine culture results	2 (4.17)	18 (37.50)	0.000	0.001	1.207
p-value ≤ 0.05, VIF (Variance Inflation Factor)					

Discussion

At the present time retrograde intrarenal surgery (RIRS) is one of the standard methods for stone of urinary system.[3] The urologists widespread use of RIRS but UTI problem are commonly seen complication.[7] UTI can turn to be severe and life threatening condition such as septicemia and sepsis .[14]

In This study , the researcher use systemic inflammatory response syndrome (SIRS) as primary end point due to SIRS following RIRS usually associate with urinary tract infection that lead to early sepsis.[11] Once sepsis signs are detected the patient need to monitor closely, give active fluid management, empirical antibiotics therapy.

Body mass index (BMI) , BMI ≥ 25 kg/m2 is one factor that associate with SIRS .In this study there were 24 patients that BMI ≥ 25 kg/m2. 17 from 24 patients had SIRS following RIRS OR 7.286 p=0.002 ,our finding is similar to previous study Cem Basatac et al[1] found that severe obese patients have higher possibility of postoperative , especially infectious complication rates.

Stone size , there are many studies that show the stone size is associated with SIRS . Such as Zhong et al[14] found that large stone burden are associated with SIRS . But the researcher found that the stone size ≥ 2cm and SIRS have no significant relationship OR=1.154 p=0.807 . We use stone size ≥ 2cm as one variable according to European association of urology (EAU) guideline that recommend to do RIRS when stone size <2 cm[11] The reasons that we do RIRS in the patients who have stone size ≥ 2cm are patient prefers and patient comorbidities. From previous study, Hua Zhang et al[13], Demirhan Orsan et al[4] found that longer operative time is are risk factor of infectious complication . Similar to this study, longer operative time affect the risk of SIRS .This study found that the cases that operative time ≥ 90 minutes have SIRS following RIRS more than the case that operative time < 90 min significantly OR = 4.25 p=0.021 . The operative time is 91.50 ± 28.92 minutes in average . This study has longer operative time than other previous study because the urologist and teams have little experience in RIRS.

Doo Soo Kim et al[6] found that preoperative pyuria was risk factor of infectious complication following RIRS . The researcher use preoperative urine culture is one of variables . This study found that preoperative urine culture is risk factor of SIRS following RIRS OR =54.625 p=0.000. 21/48 (43.75%) patients have positive preoperative urine culture results .

Implication of the results

BMI ≥ 25 kg/m2 , operative time ≥ 90 minutes and positive preoperative urine culture results are risk factors of systemic inflammatory response following retrograde intrarenal surgery.

Recommendation for the further study

Our study has the limitations

- the small populations of this study and the experience of urologist and surgical team
- This study was not a prospective cohort study in which prospective data collection would provide more complete information.

The further study should be prospective study , has many populations than this study.

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