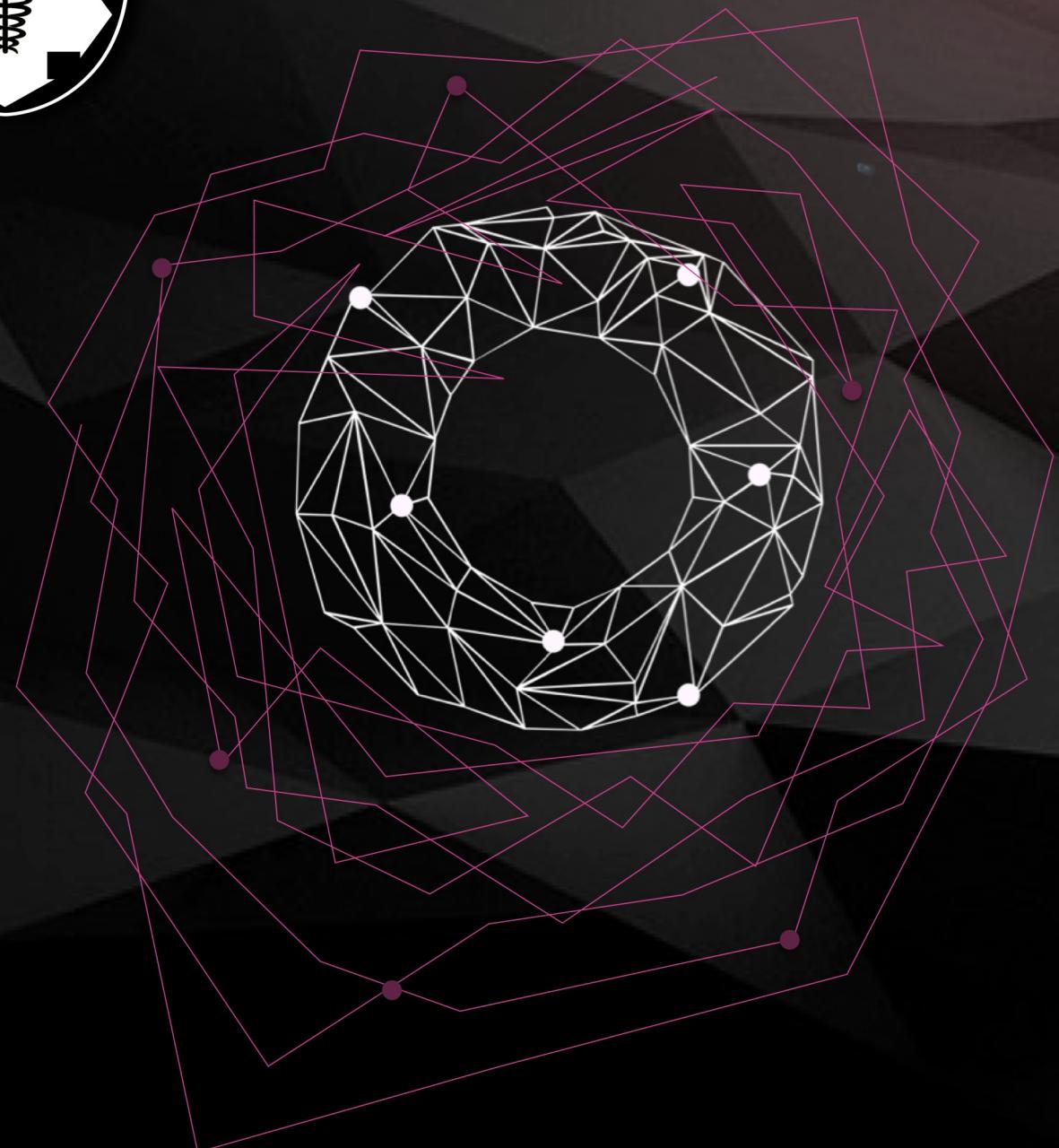




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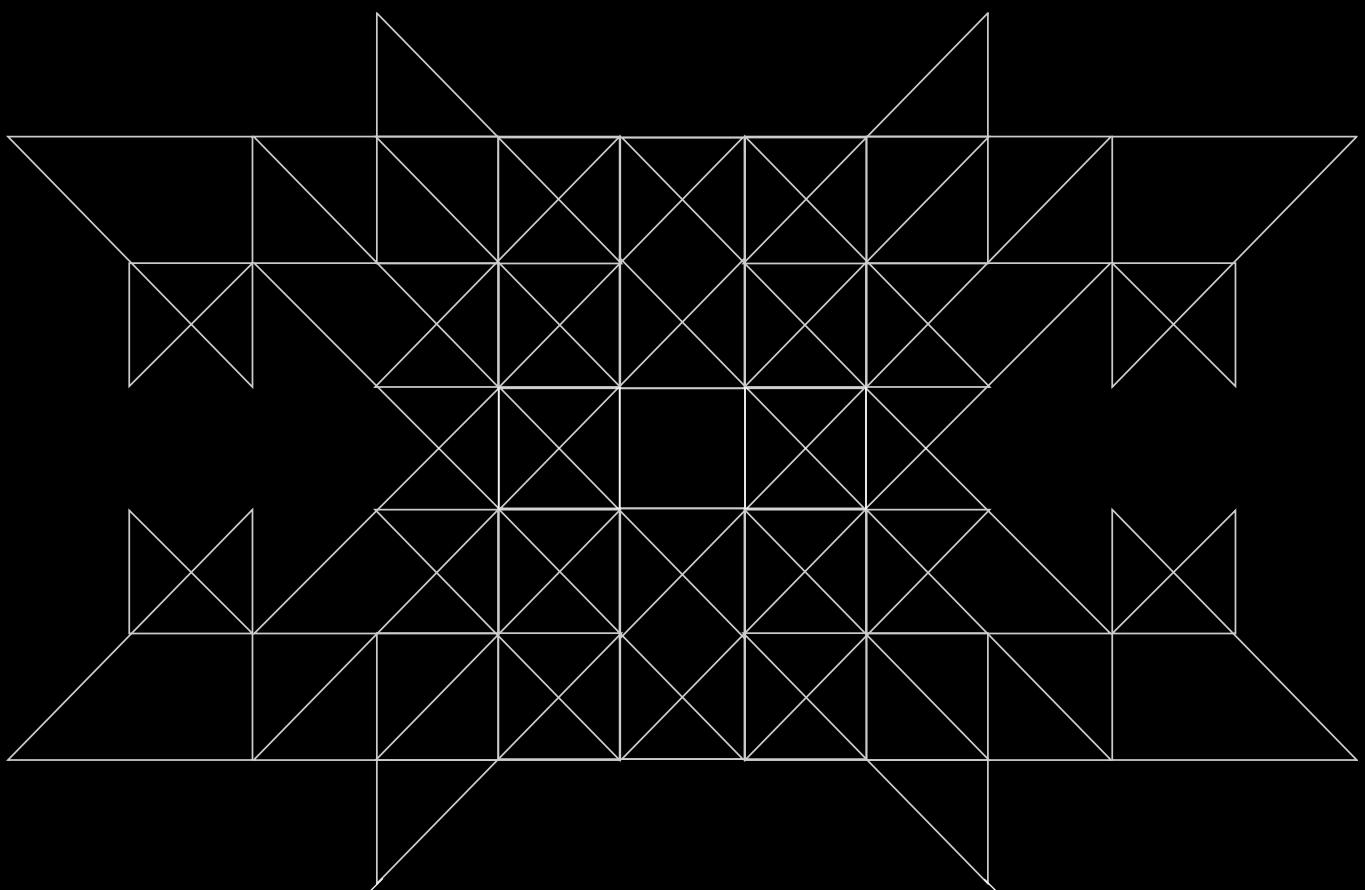
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We are about to be 40
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Since the dawn of 2016, The Clinical Academia have been published in English only. We will publish more often, six issues a year or every two months. Ethics will be the area we focus on with the practical strategic plan. As we are a part of Asean Citation Index (ACI) after we have been long in Class I of the Thai Citation Index (TCI) since the beginning of the introduction of classification system in Thailand. High quality is the must. Our passion to bring out the best in every research presented in this journal and deliver properly to our audiences is still going on. It would be no more or no less when we talking about medicine. The world of medicine always moves forward. Here now and then are its places. Keep going is the best suggestion for all of us. Gather the most of evidences before make any decisions, read between the lines to see the real information without bias. There is not thing such a panacea. Evidences are still needed for the maximum benefit of the mankind. Hope you enjoy reading our yellow issue of The Clinical Academia.

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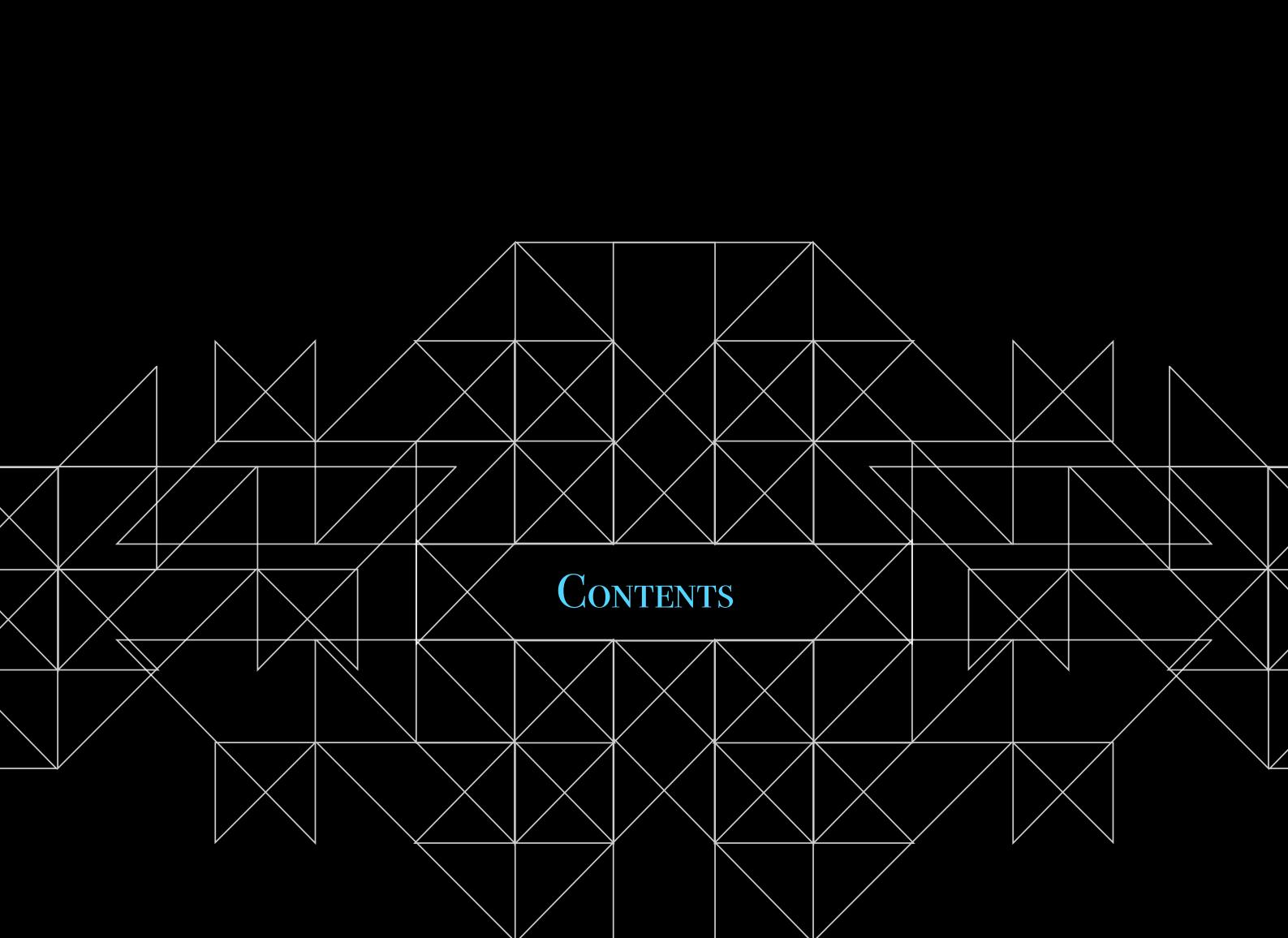
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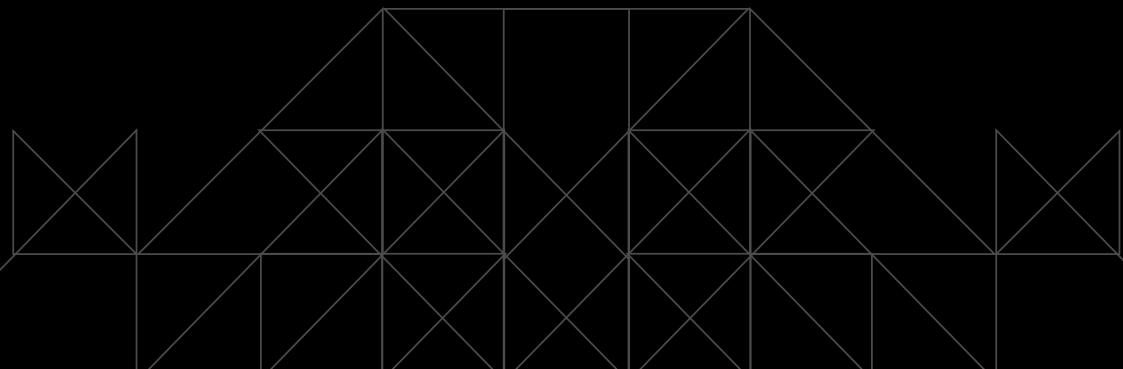
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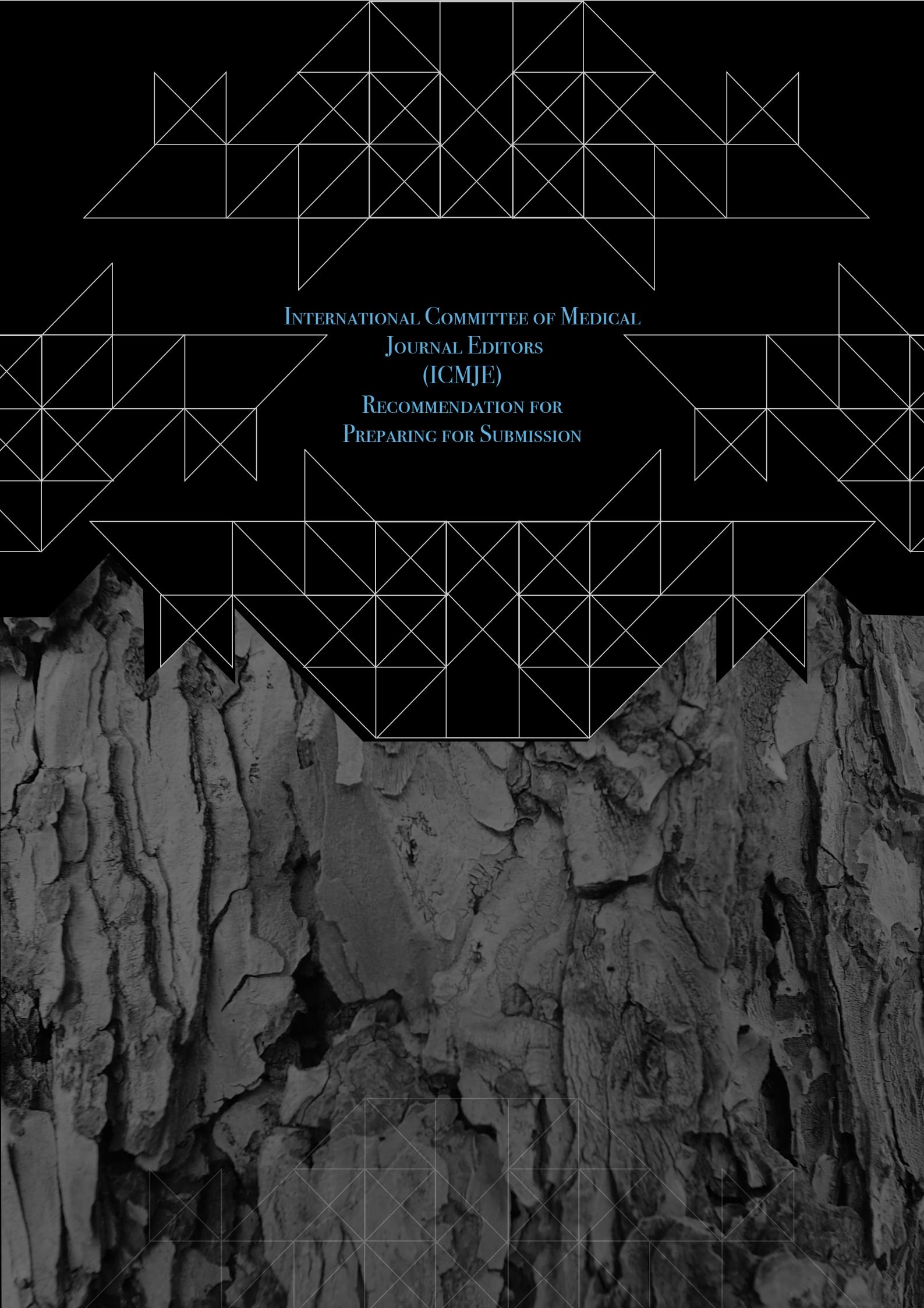
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RECOMMENDATION FOR
PREPARING FOR SUBMISSION

1. General Principles

The text of articles reporting original research is usually divided into Introduction, Methods, Results, and Discussion sections. This so-called "IMRAD" structure is not an arbitrary publication format but a reflection of the process of scientific discovery. Articles often need subheadings within these sections to further organize their content. Other types of articles, such as meta-analyses, may require different formats, while case reports, narrative reviews, and editorials may have less structured or unstructured formats.

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ORIGINAL ARTICLE

Nakornping uterine compression suture and intravenous sulprostone to prevent primary post partum hemorrhage in women with uterine atony after caesarean delivery

ORIGINAL ARTICLE BY

Jittra Witthayanukool, M.D.
Nakornping Hospital, Chiang Mai, Thailand

ABSTRACT

OBJECTIVE

To compare the effectiveness, safety and cost of applying Nakornping uterine compression suture with the intravenous sulprostone for management of primary postpartum hemorrhage (PPPH) secondary to uterine atony which failed to respond to uterotonic drugs in patients delivering by caesarean section at Nakornping Hospital.

METHODS

Retrospective cohort study of medical records of patients underwent caesarean delivery at Nakornping Hospital, Chiang Mai, Thailand between October 2011 and September 2014 was performed. The analysis was done regarding types of intervention used to manage PPH in patients with atonic uterus after caesarean delivery; Nakornping compression sutures and intravenous sulprostone. Effectiveness and safety of PPH treatment between the two study groups were compared.

RESULTS

Medical record of 3,949 were reviewed; 137 patients had atonic uterus; 61 received Nakornping sutures and 76 were treated with intravenous sulprostone. All patients receiving Nakornping suture, treatment had no intra- or post-operative complications observed. Higher incidence of complications found in patients who received sulprostone; 6 (7.9%) had relaparotomy, 2 (2.6%) underwent total hysterectomy, 2 (2.63%) received subtotal hysterectomy, and 2 (2.6%) had suture to repair uterine laceration. Blood loss and requirement for blood transfusion in patients receiving Nakornping suture was lower than ones treating with sulprostone (375.4 ± 92.1 ml vs. 519.7 ± 216.7 ml, $P < 0.001$; 29.5 ± 105.4 ml vs. 151.9 ± 361.6 ml, $P < 0.001$, respectively). Operation time was shorter among patients treating with Nakornping suture compared with the sulprostone group (39.0 ± 9.8 minutes vs. 69.3 ± 29.0 minutes, $P < 0.001$). Length of hospital stay in the suture group was shorter than in the sulprostone group (4.4 ± 0.7 days vs. 5.1 ± 1.8 days, $P = 0.016$).

CONCLUSION

Comparing with the intravenous sulprostone, Nakornping uterine compression suture was more effective and had lower rate of complication.

INTRODUCTION

Postpartum hemorrhage (PPH) is an emergency obstetric situation.¹ In Thailand, the incidence of PPH is approximately 4-6% of all deliveries.¹ Although not frequently found, when occurred, PPH is a leading cause of maternal mortality and morbidity. It is responsible for 19.7% of maternal deaths.² More than 125,000 women worldwide die every year because of PPH.³ Over seventy percent of PPH is caused by uterine atony.⁴

Postpartum hemorrhage that occurs in the first 24 hours following delivery of the baby is known as primary postpartum hemorrhage (PPPH). PPH is defined as a loss of blood of 500 ml or more within 24 hours post vaginal deliveries or more than 1,000 ml blood loss in patients delivering by caesarean delivery, a decrease in the patient's hematocrit level of more than 10%, or patients' hemodynamic instability that requires blood transfusion.^{5,6} PPH is a life-threatening obstetric situation that can lead to many serious health conditions including acute renal failure, the necrosis of anterior pituitary gland or maternal death.⁷

Numerous options, both medical and surgical treatments, have been applied to prevent and manage PPH after caesarean section.^{1,4} These therapies involve the use of bimanual compression or mechanical compression, uterine massage, uterotonic drugs, intrauterine balloon catheter, uterine artery embolization uterine vessels ligation, hypogastric arterial ligation, and hysterectomy in patients who no longer want to have more children.^{6,7} In patients who want to preserve their fertility, surgical conservative management like uterine compression sutures is the alternative approach.^{3,5} In 1997 Balogun Lynch Christopher reported that the

uterine compression suture intervention was effective in controlling postpartum hemorrhage.⁸ Since then several modifications of B-Lynch method as well as new techniques of applying sutures have been introduced for the treatment of PPPH.^{3,8} The examples of these suture techniques are Cho's Square suture⁹, Hayman suture technique¹⁰ and Pereira's technique.¹¹

Being used since 2011, Nakornping suture has been initially reported to be a highly effective, safe, easy to use, practical for training and inexpensive procedure. Comparing the effectiveness of sulprostone, the last drug of choice used in medical management of PPH at Nakornping Hospital and the Nakornping suture method can help determine whether Nakornping suture should be considered as a front line therapy for PPH. The quest for effective and safety of the interventions in the prevention and treatment of PPH between the use of Nakornping uterine compression suture and intravenous sulprostone and are the focus of this study.

METHODS

Study design

After the Nakornping Ethics Committee approved the grant for this study, this retrospective cohort study were commenced. Medical records of all patients who had caesarean deliveries between October 2011 and September 2014 at Nakornping Hospital were reviewed retrospectively.

Patients and treatment procedure

As per the standard protocol for prevention of PPH, the patient was first administered 10 units of

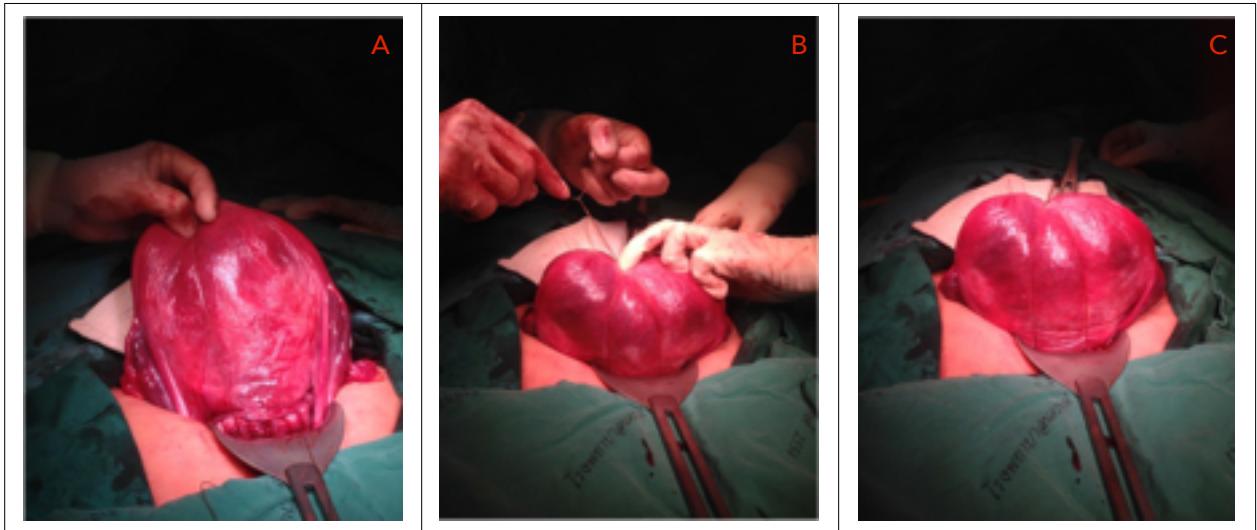


Figure I: Nakornping uterine compression suture method

oxytocin intramuscularly along with the infusion of 10 units of oxytocin in 1,000 mL of 0.9% normal saline at the rate of 20-40 milliunits per minute for a few minutes. If the uterus remains atonic, methylergotamine 0.2 mg intravenous injection is given in combination with intravenous drip of oxytocin 20 units diluted in 1,000 mL of 0.9% normal saline at the rate of 20-100 milliunits per minute. After ten more minutes if the uterine atony persists, it is considered as failure to respond to hospital standard protocol.

If this medical approach fails to control the bleeding, surgical option of hysterectomy will be performed. Striving to find alternative measures not only can manage PPH but also can preserve the uterus, Nakornping uterine compression suture was developed. This technique was modified from the B-Lynch's uterine compression suture.^{3,8,9} The Nakornping suture was placed intraoperatively after fetal extraction and hysterotomy repair. A 70 mm. straight needle with chromic catgut no.1 was used

for suturing (Figure 1 and 2). The method of applying the Nakornping suture begins with inserting the needle at 2-3 cm below uterine incision closure site and 2-3 cm from the left lateral border of the uterus, starting in the anterior aspect of the uterus and passing through the uterine cavity to the posterior aspect of the uterus. Next, pull the suture crossing over the uterine fundus from the posterior to the anterior aspect of the uterus followed by inserting the needle at the same level as the first suture point but at 2-3 cm from right lateral border of the uterus, penetrating from the anterior to posterior aspect of the uterus. Then bring together both tails of the suture, one in the anterior and one in the posterior aspect of the uterus, and tie them tightly at the middle of the fundus of the uterus. While tying the suture, uterine massage was applied to the uterus to stimulate contraction and to achieve maximum reduction of the uterine volume. Application of Nakornping uterine compression suture is similar to the Hayman technique, but easier to achieve. This is

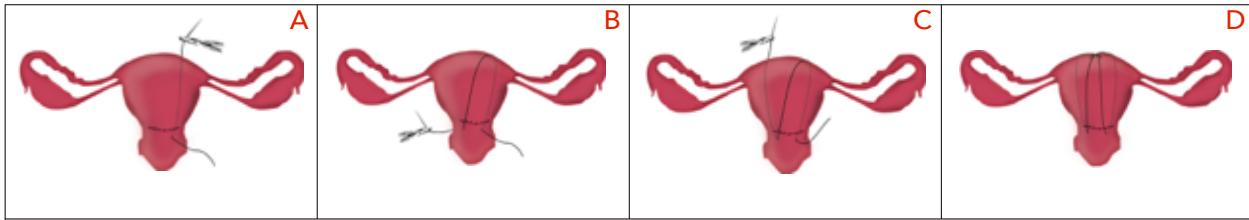


Figure 2: Method of applying the Nakorping uterine compression suture

The uterus was exteriorized; Panel A: identify the first suture point 2-3 cm. below the uterine incision closure site and 2-3 cm. from the left lateral border of the uterus. Insert a 70 mm. straight needle with chromic catgut No 1 at the first suture point from anterior aspect of the uterus through the posterior aspect; Panel B, pull the suture crossing over the uterine fundus from posterior to anterior aspect of the uterus, then insert the needle through the second suture point at the same level as the first suture point but 2-3 cm. from the right lateral border of the uterus from anterior to posterior aspect of the uterus; Panel C, bring both tails of the suture together, one in the anterior and one in the posterior aspect of the uterus; Panel D, tie both tails tightly at the middle of the uterine fundus. Uterine massage was applied to the uterus to stimulate contraction and to achieve maximum reduction of uterine volume during the suture tying time.

because the surgical notch of the Nakorping suture is to be done only one time. The Nakorping suture technique is simple and quick to apply. The average time required to complete this procedure was approximately 2 minutes.

Alternatively to Nakorping uterine compression suture, the patients might be prescribed with a prostaglandin E2 analogue sulprostone (Nalador®) 500 µg in 250 ml of 0.9% normal saline solution with the rate of 500 µg/hr intravenously and a maximum total dose of 1,500 µg/24hr.

Medical Record Review and Data Collection

Patients with uterine atony who did not respond to our hospital standard treatment protocol for prevention and treatment of PPH were identified. Demographic and clinical information pertinent to measuring the comparability of PPH outcomes which included maternal age, gestational age, number of parity, fetal birth weight, apgar score, complications,

blood transfusion, length of hospital stay and total cost of both treatment strategies were collected.

Statistical analysis

Comparison analysis of the efficacy and safety of PPH treatments between the two groups was determined using the SPSS Version 13. Results were reported in means, standard deviation (SD) for normally distributed continuous variable as well as range. Number and percentage were used for interpretation of categorical variables. Student t-test, test, relative risk with 95% confidence interval (CI) was used to compare the outcome variables between the two groups.

RESULTS

Between October 2011 and September 2014, the total number of caesarean deliveries at Nakorping Hospital was 3,949 cases. There were 137 caesarean

Characteristics	Nakorping Suture Group (N=61)	Sulprostone Group (N=76)	P Value
Age -years			
Mean±SD	28.3±6.4	29.4±6.8	0.435
Range	16-43	18-43	
Parity			
Mean±SD	2.8±1.7	2.7±1.9	0.174
Range	1-6	1-7	
Gestational age -weeks			
Mean±SD	38.3±1.9	37.8 ± 2.7	0.114
Range	31-41	29-42	
Indication of caesarean section-no. (%)			<0.001
Previous cesarean delivery	11 (18.0)	15 (19.7)	
Cephalopelvic disproportion	23 (37.7)	32 (42.1)	
Fetal distress	8 (13.1)	9 (11.8)	
Breech presentation	10 (16.4)	10 (13.2)	
Placenta previa	4 (6.6)	5 (6.6)	
Twin	5 (8.2)	5 (6.6)	
Fetal apgar score , Mean±SD			
At 1 minute	8.8±0.8	8.9±1.1	0.194
At 5 minute	9.8±0.6	9.7±0.6	0.172
At 10 minute	9.9±0.3	9.9±0.3	0.489
Fetal body weight -grams			
Mean±SD	3,069.9±628.0	3,022.7±666.1	0.673
Range	1,703-4,230	1,032-4,200	

deliveries complicated by uterine atony which did not respond to the hospital standard treatment protocol for prevention and treatment of PPH. Of these, 61 (44.5%) patients received Nakorping uterine compression suture and 76 (55.5%) patients received intravenous sulprostane to control bleeding.

There were no statistically significant differences in demographic data and neonatal outcomes between the groups (Table 1). All patients receiving uterine compression with Nakorping sutures, the hemorrhage was controlled and the uterus were all preserved (Table 2). Pelvis ultrasound performed during the follow up examination of two patients on day 3 and day 7 after the operation to examine the uterus reviewed normal contour of uterus with no fluid retention in the uterine cavity (Figure 3). Follow up examination using hysterosalpingography on week 6 after operation on two patients to evaluate their fertility showed normal findings (Figure 4). Four patients who received Nakorping uterine compression suture reported having conceptions with successful pregnancies and caesarean deliveries.

On the contrary, an increased incidence of complications was reported in patients who received intravenous sulprostane. (Table II) Six patients needed to have relaparotomy, two patients underwent total hysterectomy, two patients received subtotal hysterectomy, and the other two needed suture to repair the lacerated uterus and to evacuate the hematoma. The complication of patients in Nakorping suture group was significantly lower than that of sulprostane group (RR, 0.66; 95% CI 0.50 to 0.89; P=0.02). Total blood loss and the requirement for blood transfusion in pregnant women receiving Nakorping uterine compression

suture was lower than ones treating with intravenous sulprostane (375.4 ± 92.1 ml vs. 519.7 ± 216.7 ml; P<0.001; 29.5 ± 105.4 ml vs. 151.9 ± 361.6 ml; P<0.001), respectively (Table 3). Treatment time was shorter among patients who treated with Nakorping uterine compression suture compared with the intravenous sulprostane group (39.0 ± 9.8 minutes vs. 69.3 ± 29.0 minutes; P<0.001). The length of hospital stay in the suture group was shorter than in the sulprostane group (4.4 ± 0.7 days vs. 5.1 ± 1.8 days; P=0.016). From logistic regression, the only factor that was associated with positive treatment outcome was the application of Nakorping suture. Thus, the author would present the outcome using the RR rather than odds ratio.

DISCUSSION

In patients with PPH, comparing Nakorping uterine compression suture and intravenous sulprostane in this study, the findings showed that the Nakorping compression suture approach was more superior to the use of sulprostane; treatment in all patients receiving Nakorping uterine compression suture was successful. Bleeding was stopped almost immediately following the completion of the procedure. The blood loss and requirement for blood transfusion was lower in the Nakorping suture group than that of sulprostane group. No intra or post operation complications were reported. None of the patients receiving Nakorping suture treatment require intensive care or readmit from complications related to the procedure, whereas, the incidences of total hysterectomy, subtotal hysterectomy and hematoma evacuation and suture to repair the lacerated uterus were reported in the sulprostane

Table 2: Categorical treatment outcomes.

Outcomes	Nakornping Suture Group (N=61)	Sulprostone Group (N=76)	Relative risk (95% confidence interval)	P Value
Complete control of bleeding-no. (%)	61 (100.0)	70 (90.8)	0.92 (0.86-0.98)	<0.001
Relaparotomy-no. (%)	0	6	0.54 (0.44-0.68)	0.001
Total hysterectomy	0	2 (2.6)		
Subtotal hysterectomy	0	2 (2.6)		
Suture uterine laceration	0	2 (2.6)		
Required blood transfusion -no. (%)	5 (8.2)	17 (22.3)	0.66 (0.50-0.89)	0.02

Table 3: Continuous treatment outcomes.

Outcomes	Nakornping Suture Group (N=61)	Sulprostone Group (N=76)	P Value*
Blood loss-milliliter			
Mean \pm SD	357.4 \pm 92.1	519.74 \pm 216.65	<0.001
Range	300-600	200-1,200	
Blood transfusion-milliliter			
Mean \pm SD	29.5 \pm 105.4	151.9 \pm 361.6	<0.001
Range	0-600	0 - 2400	
Length of stay in hospital-days			
Mean \pm SD	4.4 \pm 0.7	5.1 \pm 1.8	0.016
Range	4-7	4-12	
Operational time-minutes			
Mean \pm SD	39.0 \pm 9.8	69.3 \pm 29.0	<0.001
Range	20-80	30 -170	

* P Value for relative risk was computed for categorical outcomes and for student t-test for continuous outcomes.

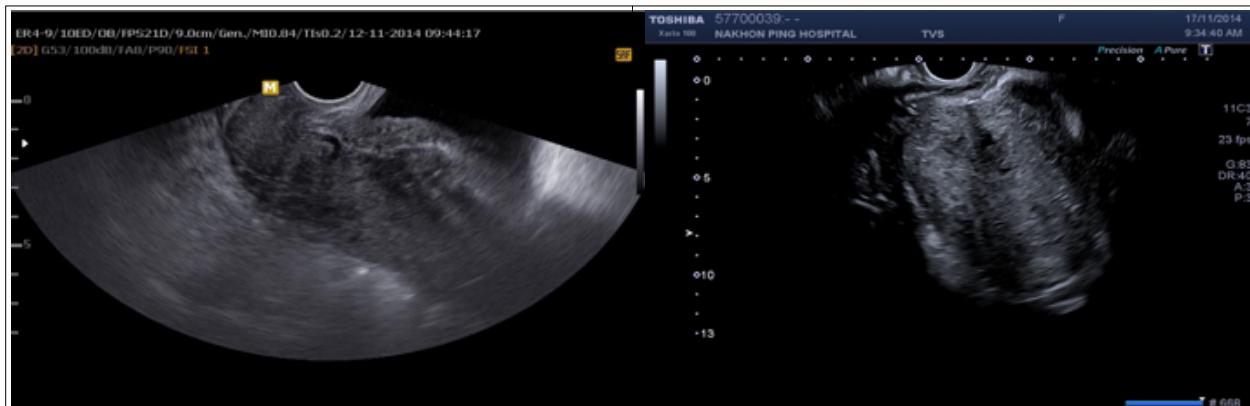


Figure 3: Pelvis ultrasound findings on two patients on day 3 and day 7 after post operation

group. The present study also revealed the shorter time regarding treatment time and length of hospital

stay in the Nakorping suture group than that of sulprostome group.

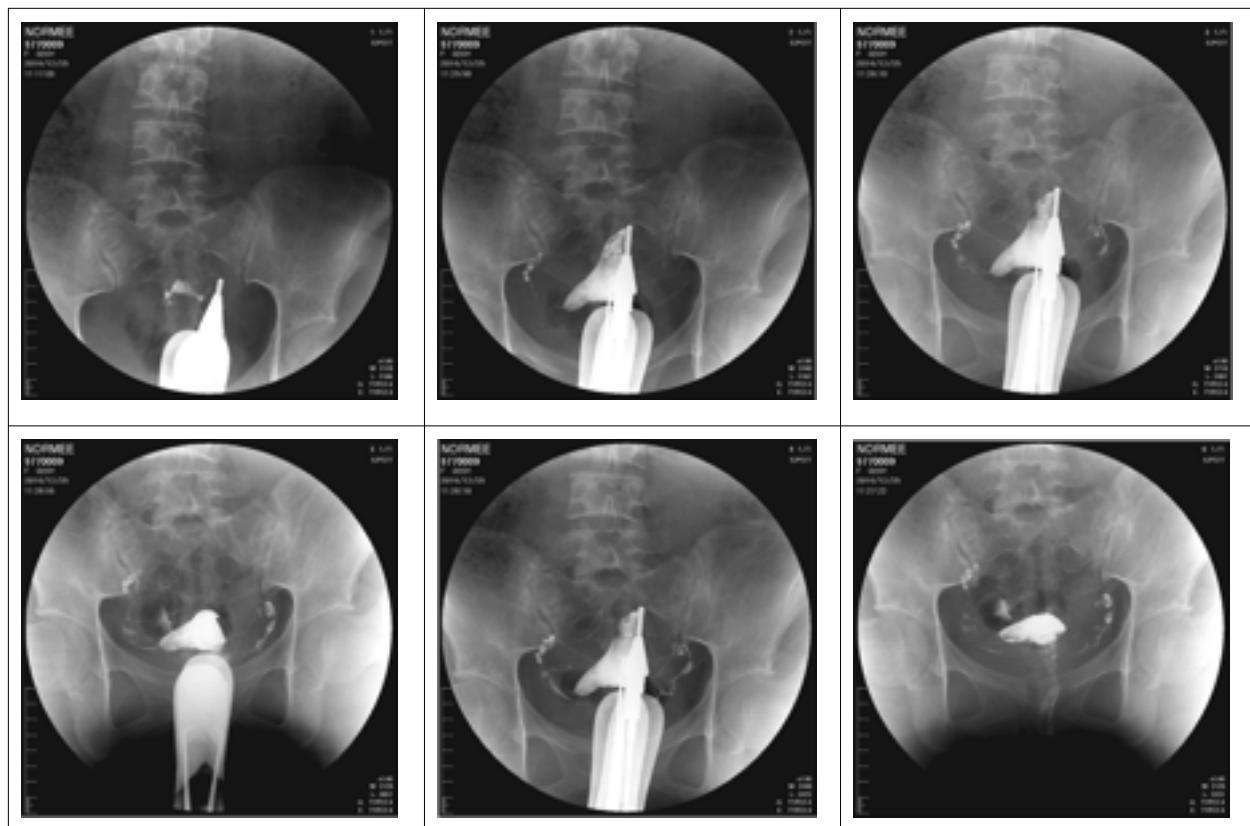


Figure 4: Hysterosalpingography findings on two patients on week 6 after operation to evaluate patients fertility

Comparison with other studies

Previous studies reveal that the B-Lynch and other modification uterine compression suture techniques have more than 90% success rate for PPH management.^{13,14} In this study, Nakornping suture, a modified B-Lynch technique yields equal effectiveness (100%) but is simpler and faster to perform.¹⁵ On the other hand, the effectiveness of the intravenous sulprostone for managing PPH in this study is 90% which is similar to the results reported on studies done in the past decades.^{16,17} There are variety of factors that can be an obstacle for the success of PPH prevention and treatment. One of which is the delay in receiving treatment.^{1,2} As our hospital is a referral center institution, we receive patients who reside in Chiang-Mai as well as the ones referred from other hospitals; some located in the remote areas of surrounding cities such as Meahongsorn and Lampoon. The referral processing time, therefore, differs. The referral time can be as short as one hour or less or as long as four hours depending on how far away the sub-district hospitals are and how difficult and dangerous the transportation access is from those hospitals to ours. The longer the referral time, the higher the maternal morbidity and mortality. The other important factor that can cause delay in receiving treatment is the unavailability for the use of sulprostone in small hospitals. As sulprostone is an expensive uterotonic drug, only available in large referral centre hospitals. The delay in receiving sulprostone can result in increased risk of severe postpartum hemorrhage, failure to control the bleeding, inevitable hysterectomy, higher complications or even life of the patient. Another crucial factor is the shortage of highly trained and skilled surgical specialists to

perform hysterectomy, a complex and high risk surgical procedure used after uterotonic drugs fail to control bleeding. These emphasize the need for safe, effective, fast and simple measures to arrest the bleeding and Nakornping uterine compression suture can be the solution.

Strengths and limitations

As mentioned that Nakornping hospital is a referral center institution, therefore, we are not able to follow up all of the patients beyond their being discharged from our hospital. During the follow up appointments, 39 of 61 patients in the Nakornping suture group and 51 of 76 patients in sulprostone group attended the appointment. However, upon the follow up examinations, it is found that Nakornping uterine compression suture method had no negative impact on the change of the uterine cavity, the contour of uterus or on the fertility of the patient. Four patients in the suture group had conceptions and successful pregnancies two years later and had caesarean deliveries with no complications. Although this was an evidence of the patient's normal uterine and fertility function, it cannot be totally conclusive.

The author acknowledged the weakness of this study concerning small population size, small number of patients attending the follow up examinations and narrow length of follow up time. Also, the author realized that only a larger and longer study would confirm whether there truly is no change in uterine contour and maternal fertility. A further study on larger sample size with long-term follow up window was suggested.

Conclusion and implications

In conclusion, the present study demonstrated that application of the Nakornping uterine compression

suture to manage PPH secondary to uterine atony during caesarean delivery was more effective and safer compared with the use of the intravenous sulprostene. Therefore, the Nakornping suture should be considered as an alternative option in the prevention and treatment of postpartum hemorrhage. Despite the limitation, compared with other methods we have in place at the Nakornping Hospital at the present time, the findings of this study found Nakornping uterine compression suture

a promising method for PPH prevention and treatment over sulprostene. The quickness of the suturing which takes merely a few minutes to complete makes an intervention a method to consider for an emergency management of PPH. The simplicity of the technique makes it not only easy for use but also feasible in term of training. Therefore, it is applicable to consider Nakornping uterine compression suture technique as one of the frontline therapy for PPH.

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Data Envelopment Analysis to assess the efficient hospital management and the efficiency of budget allocation of the Universal Health Coverage Scheme in Thai public hospitals

ORIGINAL ARTICLE BY

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ABSTRACT

OBJECTIVE

To measure the technical efficiency of public hospitals under the Office of the Permanent Secretary, the Ministry of Public Health and to assess the adequacy and efficiency of budget allocation of the Universal Health Coverage Scheme (UCS) to those hospitals using Data Envelopment Analysis (DEA)

METHODS

This was a cross-sectional study. Input-orientated DEA was used to measure the technical efficiency of 822 public hospitals under the Office of the Permanent Secretary, the Ministry of Public Health, Thailand. The efficient minimum operating cost of each hospital was its efficiency score multiplied by its minimum operating cost and compared with the budget allocation.

RESULTS

There were 131 efficient decision making units (DMUs) from 822 DMUs for overall technical efficiency scores, and the minimum score was 0.406. The hospital management of regional hospitals was more efficient than that of general hospitals and community hospitals, respectively. The study revealed the revenue from the UCS was less than the efficient minimum operating cost from the UCS; there were 618 hospitals, representing 75.2%, or calculating 20.9 billion THB. While the revenue from the UCS was more than the efficient minimum operating cost from the UCS; there were only 204 hospitals, representing 24.8%, or calculating only 1.8 billion THB. The results showed the problems of inappropriate allocation of the UCS budget to each hospital; too low and too high in some facilities. In addition, the total budget from the UCS was less than the total efficient minimum operating cost from the UCS to all hospitals. The difference was 19.0 billion THB.

CONCLUSION

In the usual hospital groups excluding two hardship groups, the hospital management of regional hospitals was more efficient than that of general hospitals and community hospitals, respectively. Moreover, DEA was used to assess the adequacy and efficiency of budget allocation using the efficiency score multiplied by the minimum operating cost of each hospital for funding requirement

INTRODUCTION

The Universal Health Coverage has been designed for all people to receive quality health services that they need without suffering from financial hardship. Because medical technology and the demand for health services are constantly increasing, so the trend of healthcare budget will increase gradually.¹ A global budget defines the volume of service that is to be delivered, its total price and a defined time period. The most important objective of a global budget is to place a limit on the total amount of money spent on healthcare.² The hospital global budget is a total expenditure or operating expenses of the hospital must be contained.² In Thailand, the gradual increases in the rates of healthcare utilization indicated improving access to care; the overall outpatient and inpatient services among the Universal Health Coverage Scheme (UCS) members rose continuously from 2003 to 2011, with outpatient visits per person increasing from 2.45 to 3.23, and inpatient admission per person increasing from 9.42 to 11.40 percent.³⁻⁴ The outpatient and inpatient utilization rates of the poorest group were significantly higher than those of the richest group.⁵ The establishment of an autonomous National Health Security Office (NHSO) as a purchasing agency, was to ensure the use of the primary care facility as the gatekeeper and contracting unit, the use of closed-end provider payment methods and competition between public and private health providers.⁶

Hospitals as the most expensive and important component of healthcare systems require special consideration, and more than 70% of health

resources are allocated to hospital services in developing countries.⁷ Their productivity and efficiency of resource utilization should be reviewed and analyzed.⁷ An efficient unit utilizes all of its available inputs and produces the maximum number of outputs, given present technological knowledge.⁸ In area of health economy, two tools used in evaluating hospital performance including (i) Data Envelopment Analysis (DEA), a non-parametric mathematical programming approach to frontier estimation⁹ and (ii) Stochastic Frontier Analysis (SFA).⁹⁻¹¹ However, DEA can be an appropriate model for the operational budgeting of governmental departments, such as schools, banks, and hospitals for which information on prices rarely exists or is incomplete.⁷ The technically inefficient health facility uses more weighted inputs per weighted output, or produces less weighted output per weighted input than those health facilities on the "best practice frontier."¹²⁻¹³ This study aimed to measure the technical efficiency of public hospitals under the Office of the Permanent Secretary, the Ministry of Public Health and to assess the adequacy and efficiency of budget allocation of the UCS to those hospitals using DEA

METHODS

Study design

This was a cross-sectional study. to measure the technical efficiency of 822 public hospitals under the Office of the Permanent Secretary, the Ministry of Public Health, Thailand between 2012 and 2013. The study was divided into two parts as described below.

Part I: Evaluation of the efficient hospital management or hospital performance using DEA

Analysis with input-oriented DEA and the VRS approach by DEAP software. The efficiency score is between 0-1. The efficiency score of 1 means the hospitals in the study groups use the lowest resources or inputs to produce the highest outputs, or refers to the most effective performance hospitals or "the best-practice frontier."¹⁴ The efficiency score between 0 and 1 means inefficient hospital management.¹⁴ The degree of inefficiency depends on the efficiency score near zero. The efficiency score of 0 means the hospitals in the study groups use the highest resources or inputs to produce the lowest outputs, or refers to the least effective performance hospitals.

In this part the target was 822 public hospitals under the Office of the Permanent Secretary, the Ministry of Public Health. Environmental factors can be taken into account in efficiency analyses: within a similarly constrained environment, analogous to 'factors' in the production process, and undertake risk adjustment.¹⁰ Thus, proper hospital grouping is actually important in assessing performance. To fairly compare the hospital management, the hospitals were grouped as subgroups of similar sizes and similar context in 8 hospital groups (Table 1). Hardship 1 (HS 1) and hardship 2 (HS 2) are in the hospital groups which have specific characteristics as the unusual groups, including the hospitals in remote areas, islands and border areas with political situations. There are 2 hardship groups; the hardship 2 has more suffering than the hardship 1 due to the classification by the Bureau of Policy and Strategy, Ministry of Public Health.

Table 1: Groups of hospitals.

Groups of hospitals	Number
Regional hospital (>500 beds)	35
General hospital (150-<500 beds)	60
Community hospital with 90-<150 beds	73
Community hospital with 60-<90 beds	140
Community hospital with 30-<60 beds	350
Community hospital with <30 beds	42
Hardship 1	72
Hardship 2	50

Data regarding health services in 2012 were from reports from the Bureau of Health Administration, the Ministry of Public Health while data in relation to finance were from accounting data of the fiscal year 2013 from the Health Insurance Group Office, the Office of the Permanent Secretary, the Ministry of Public Health. This study focuses on labour cost and material cost of each hospital for inputs of hospital management, the outpatient visits for outpatient services, and the number of inpatient admission number multiplied by case mixed index (CMI) for inpatient services.¹¹

Part 2: Using DEA to assess the efficiency of budget allocation of the UCS to the public hospitals in Thailand

The DEA efficiency score is used as the performance indicator to develop funding requirements for each unit or DMU for enhancement of performance-based budgeting.¹⁵ The efficient minimum operating cost of each hospital is its efficiency score multiplied by its minimum operating cost. Later, comparing the

Table 2: Efficiency score regarding groups of hospitals.

Groups of hospitals	Efficiency score Mean (SD)	Range	No. (%) of hospitals with hospital efficiency score			
			1	0.8-<1.0	0.6-<0.8	0.4-<0.6
Regional hospital (>500 beds)	0.912 (0.090)	0.682-1.000	10 (28.6)	20 (57.1)	5 (14.3)	0
General hospital (150-<500 beds)	0.865 (0.109)	0.668-1.000	16 (25.4)	26 (44.1)	18 (30.5)	0
Community hospital with 90-<150 beds	0.834 (0.125)	0.553-1.000	13 (17.8)	34 (46.6)	25 (32.9)	2 (2.7)
Community hospital with 60-<90 beds	0.834 (0.115)	0.516-1.000	19 (13.6)	64 (45.7)	53 (37.9)	4 (2.9)
Community hospital with 30-<60 beds	0.762 (0.156)	0.426-1.000	45 (12.9)	96 (27.4)	148 (42.3)	61 (17.4)
Community hospital with <30 beds	0.776 (0.141)	0.545-1.000	6 (14.6)	11 (26.8)	20 (48.8)	4 (9.8)
Hardship 1	0.826 (0.128)	0.494-1.000	11 (15.3)	31 (43.1)	26 (36.1)	4 (5.6)
Hardship 2	0.826 (0.149)	0.406-1.000	11 (22.0)	20 (40.0)	14 (28.0)	5 (10.0)

revenue and the efficient minimum operating cost from the UCS in each hospital was conducted.

RESULTS

Out of 835 hospitals, there were 822 hospitals (98.4%) with complete data for the study. The largest group was 350 community hospitals with 30 to <60 beds, representing 42.6%. The second largest group was 140 community hospitals with 60 to <90 beds, representing 17.0%.

Part 1: Evaluation of the efficient hospital management or hospital performance using DEA
The results of efficiency analysis of the hospitals under the Office of the Permanent Secretary, Ministry of Public Health are showed in Table 2. In the usual

hospital groups (excluded two hardship groups), the hospital management of regional hospitals was more efficient than that of general hospitals and community hospitals respectively as the mean of efficiency scores.

In the usual hospital groups, the percentage of hospitals with the efficiency score of 1.0 descended according to hospital types; regional hospitals, general hospitals, community hospitals with 90 to <150 beds, community hospitals with 60 to <90 beds, community hospitals with <30 beds) and community hospitals with 30 to <60 beds, respectively.

In the low performance groups, their efficiency scores were between 0.4 to <0.6. This study found the largest hospital group was 61 community hospitals with 30 to <60 beds,

Table 3: Estimated income and efficient minimum operating cost of the UCS regarding groups of hospitals.

Groups of hospitals	Estimated USC income in 2014 (million THB)		Efficient minimum operating cost of UCS (million THB)	
	Mean (SD)	Range	Mean (SD)	Range
Regional hospital (>500 beds)	571.5 (28.3)	196.4-1,447.6	757.4 (359.4)	392.4-2,245.2
General hospital (150-<500 beds)	180.4 (97.9)	39.0-416.1	293.2 (131.2)	93.1-719.1
Community hospital with 90-<150 beds	100.3 (49.2)	0.7-289.2	121.0 (51.3)	45.0-286.2
Community hospital with 60-<90 beds	63.0 (29.4)	20.9-167.9	73.9 (29.3)	30.9-237.5
Community hospital with 30-<60 beds	36.4 (16.5)	2.4-108.9	41.0 (17.3)	8.6-119.7
Community hospital with <30 beds	23.3 (9.7)	6.3-48.8	27.0 (13.1)	11.3-88.6
Hardship 1	33.7 (17.9)	5.1-93.7	40.6 (21.4)	14.2-121.0
Hardship 2	39.2 (19.5)	9.3-86.8	47.7 (24.2)	8.2-104.4

representing 17.4%, while there were two groups with no hospitals in this interval score such as the group of regional hospitals and general hospitals.

Part 2: Using DEA to assess the efficiency of budget allocation of the UCS to the public hospitals in Thailand

In this study, only the income from Thailand's USC forecasting for 2014 was taken into consideration, Table 3 shows the estimated UCS income decreased respectively from high to low, from the regional hospitals, general hospitals to community hospitals

The minimum operating cost (MOC) meant only the essential labour cost and the essential material cost of each hospital. The minimum operating cost of the UCS was calculated from total operating cost multiplied by the proportion of the UCS income and total income for one year in each hospital because the data of the proportion of the

UCS cost were not available. The efficient minimum operating cost in the part of the UCS was the minimum operating cost of the UCS multiplied by the efficiency score of each hospital. When considering the mean of efficient minimum operating cost of UCS of the hospitals in the normal groups, the efficient minimum operating cost of the UCS descended according to the level of the hospital and the number of beds from regional hospitals, general hospitals to community hospitals.

The fair budget distribution to each hospital should not allocate less than the minimum operating cost of each hospital and hospital performance should be monitored to improve efficiency. The total minimum operating cost (UCS and non UCS) for all hospitals under the Office of the Permanent Secretary, Ministry of Public Health was 152.0 billion THB, while the total efficient minimum operating cost (UCS and non UCS) was 125.8 billion

Table 4: Estimated income and efficient minimum operating cost of the UCS regarding groups of hospitals.

Groups of hospitals	Revenue from the UCS		Deficit of revenue from the UCS	
	No.	Million THB	No.	Million THB
Regional hospital (>500 beds)	35	20,003.0	32	-6,623.1
General hospital (150-<500 beds)	60	10,824.7	59	-6,770.4
Community hospital with 90-<150 beds	74	7,424.2	62	-1,715.8
Community hospital with 60-<90 beds	140	8,823.0	114	-1,827.2
Community hospital with 30-<60 beds	350	12,732.2	231	-2,665.3
Community hospital with <30 beds	41	956.8	27	-212.0
Hardship 1	72	2,425.5	59	-558.9
Hardship 2	50	1,962.0	34	-502.2
Total	822	65,151.4	618	-20,875.0

THB. The total inadequate budget for all hospitals was 26.1 billion THB.

Considering the difference of the revenue from the UCS and the efficient minimum operating cost from the UCS of each hospital, the hospitals with the positive result meant they had more income than expenses while negative result meant they had less income than expenses. The study showed the revenue from the UCS was less than the efficient minimum operating cost from the UCS in 618 hospitals, representing 75.2%, or calculating 20.9 billion THB. The revenue from the UCS was more than the efficient minimum operating cost from the UCS, in only 204 hospitals, representing 24.8%, or calculating only 1.9 billion THB. The results showed the problems of inappropriate allocation or distribution of the UCS budget to each hospital; some hospitals received too much, but some

hospitals received too low. The total budget from the UCS was 19.0 billion THB less than the total efficient minimum operating cost from the UCS to all hospitals under the Office of the Permanent Secretary, The Ministry of Public Health. The inadequate allocation and inappropriate distribution of the UCS budget to the hospitals affected the low quality of healthcare services. The causes of inadequate budget allocation were that the received budget from the government was lower than the estimated purchasing budget, and that the purchase of healthcare services from the hospitals was lower than the benefit packages setting.

When considering the details of the revenue from the UCS which was less than the efficient minimum operating cost from the UCS, there were 618 hospitals in that situation, representing 75.2%; the calculating 20.9 billion THB was found that it was

scattered in all levels of hospitals. Considering the value of money, most of the hospitals were in the groups of regional hospitals and general hospitals; however, considering the number of hospitals, it was in the groups of community hospitals, especially the ones with 30 to <60 beds and those with 60 to <90 beds.

DISCUSSION

Principal findings

When the hospital grouping was appropriately set, multiple input data and multiple output data were selected to measure hospital efficiency through input-oriented DEA for cost-minimizing efficiency analysis.¹⁴ The efficiency score of each hospital identified the efficient performance itself. The maximum efficiency score was 1.0 or 100%, while the lowest efficiency score was 0 or 0%.^{9,12} In the present study we found that in the usual hospital groups excluding two hardship groups, the hospital management of regional hospitals was more efficient than that of general hospitals and community hospitals, respectively.

There were inefficient performance of hospitals using the DEA in all groups at all levels of hospitals. The revenue of public hospitals were limited, therefore the performance should be improved by cost reduction. The inefficiency was caused by the non-effective use of the inputs and/or the non-effective outputs production. Therefore, an evaluation of the slack for inputs and outputs was serious for efficiency improvement.^{9-10,13,16} The reduction of cost can apply the slack score of hospital in each item; operating cost, labour cost, or material cost, from DEA as the target of cost reduction in each

hospital to reduce according to the possibility of each hospital. The slack score of hospital computed from DEA is the score gap that is different from the maximum efficiency score at 1.0 (the slack score is equal to 1.0 minus its efficiency score). The slack score can transfer to the excess cost which equals the slack score multiplied by the cost that the efficiency score at 1.0, or it means the excess cost that the hospital should reduce to the efficient cost in each item.

Comparison with other studies

Hospital performance or hospital management was evaluated by DEA and reported for benchmarking and ranking in each group of hospitals.^{13,15,17-21} For fairness, budget allocation to the public hospitals was not less than the minimum operating cost of each hospital, and the amount of budget was allocated to each hospital depending on its hospital performance using the efficiency score multiplied by the minimum operating cost of each hospital. The DEA performance indicator was used to derive the funding requirement at the level of individual hospital, group of hospitals or overall funding requirement for all hospitals.¹⁵ DEA scores helped hospital performance monitoring to maximize the government budget utilization, fairly allocate the budget, and reduce unnecessary costs.

Limitations of the present study

In this study, financial data used (fiscal year 2013) were those of a different year with the service data (fiscal year 2012) due to the need to allocate the budget to the hospitals in the fiscal year 2014. It is essential to use the most current financial data as available. While the service data cannot support the performance of the same year, they do not reflect the actual hospital performance. The financial data and

service data should be the data of the same year to assess the hospital performance. In fact, most hospitals under the Office of the Permanent Secretary, the Ministry of Public Health usually do not change much each year, so it is assumed that the output of service does not change, except in some hospitals with changes in some important factors such as the hospital director, specialist doctors, specialist nurses, new technology and new medical equipment.

In this study, the service data of health promotion and disease prevention were not used because of the lack of the good proxy data set of health promotion and disease prevention representing their output or outcome in one year. Health promotion and disease prevention are core business like healthcare processes in the small community hospitals, thus, their productivity was counted below the usual level, but it did not affect much because the hospital performance was compared in the same level of hospitals and the similar context group.

Conclusions and implications

In the usual hospital groups excluding two hardship groups, the hospital management of regional hospitals was more efficient than that of general hospitals and community hospitals, respectively. Benefits of performance evaluation of hospitals using DEA includes evaluation of hospital performance or hospital management using efficiency score.

Hospital grouping with similar context is very important in assessing hospital performance. The budget allocation of Thai UCS was allocated by per capita to hospitals according to the number of the UCS population basis adjusting with age

structure and service portfolios. So, the hospitals with high UCS population will take more revenue and more advantages than the hospitals with low UCS population. Thus, the next study should categorize the group of UCS population in similar groups for fair assessment. In the further study, the financial data and service data should be assessed in the same year, and try to find out the proxy data set of health promotion and disease prevention to represent the more accurate hospital productivity. The assessment of hospital performance should be assessed every year in order to utilize and improve the quality of financial data and service data regularly. The continuous hospital performance assessment will evolve administrators to seriously focus on the effective and efficient management, develop a sustainable system of efficient financial management, and create a good organizational culture in the future.

We can also use it for budget adequacy assessment and fair budget allocation using the efficiency score multiplied by the minimum operating cost of each hospital for funding requirement. The healthcare service sector should have total revenue not less than total minimum operating cost for quality services so the governmental health budget should be allocated adequately to public hospitals in each year. In cases of very low efficiency scores, the reduction of operating cost below 15% to improve the hospital efficiency is very difficult; especially for non-professional administrators, because there was the problem of inadequate budgets for the operation of the hospital with quality services. The budget allocation should be applied depend on the intervals of hospital efficiency scores such as the hospital efficiency scores with 1.0 or the most efficient

hospitals should receive budget 100% of the minimum operating cost of each hospital, the hospital with efficiency scores with 0.8 to <1.0 should receive budget 95% of the minimum operating cost of each hospital, the hospital with efficiency scores with 0.6 to <0.8 should receive

budget 90% of the minimum operating cost of each hospital, and the hospital with efficiency scores with 0.4 to <0.6 should receive budget 85% of the minimum operating cost of each hospital. All inefficient hospitals must make the letter of intent to improve the hospital performance.

ACKNOWLEDGEMENT

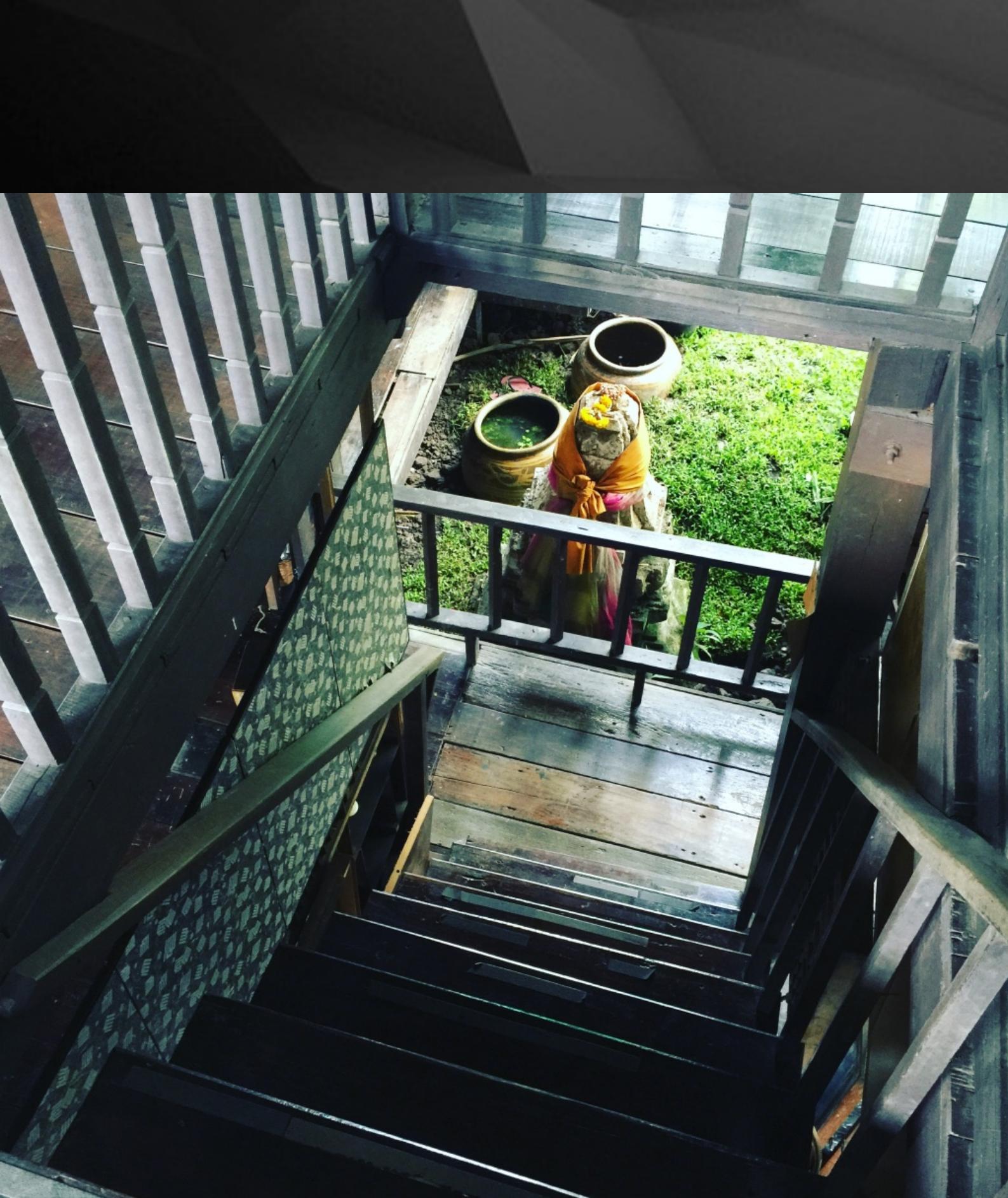
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Differentiation of benign and malignant breast mass by using flow pattern from color Doppler ultrasonography

ORIGINAL ARTICLE BY

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ABSTRACT

OBJECTIVE

To identify certain vascular features of breast masses observed by color Doppler ultrasonography (CDUS).

METHODS

This was a cross-sectional study conducted at Out-Patient Department, Khon Kaen Hospital, Khon Kaen, Thailand between February 2014 and February 2015. The study involved ambulatory patients having ultrasonographic breast examination. CDUS was used to diagnose and classify benign and malignant breast tumor in addition to echogenicity findings by comparing the echogenicity, textural feature and flow or vascularity comparing with the pathology or tissue diagnosis after the masses have been excised.

RESULTS

There were 1,438 walk-in-OPD patient having ultrasound breast examination; 233 case of solid breast masses have no vascular flow and all of them are fibroadenoma; 192 cases with abnormal echogenicity and vascular flow breast masses went to follow up at surgical department after mammogram and ultrasound breasts have been reported hypervascular lesion with tortuous vessels central and peripherally had sensitivity of 47.7%, specificity of 100% and and positive predictive value 100%.

CONCLUSION

The combination of gray-scale ultrasound with data of vascular flow pattern from CDUS can enhance the accuracy of the diagnosis of malignant breast tumor with specify 100% and positive predictive value 100%.

INTRODUCTION

Breast cancer is one of the majority of carcinoma among women except from cervical carcinoma and it seems to be raising up in the recently decades.¹ Early detection is an effective way to control the disease.² Practically harmless, ultrasound is one of the most effective and popular approaches for early detection of breast cancer.³

Flow data is usually recorded for tumor vascularity particularly has played an important role in promoting cancer growth, invasion and metastasis malignant tumor has copious blood apply.⁴⁻⁷ Color Doppler ultrasonography (CDUS) has a value in diagnosis and classifying benign and malignant breast lesion.⁴ It has been proved that CDUS imaging can improve the diagnostic accuracy of gray scale imaging of abnormality of blood flow or tumor vascularity.⁴

Using high resolution of β -mode ultrasound can detect non-palpable breast tumor and in combination with flow detection is highly desirable.⁸ However the CDUS in an operator dependent this make the comparison of each study difficult.⁹ Various flow parameters have been evaluated in different studies. Most of the radiologists use echogenicity of the lesion in combination with blood supply of the tumor.¹⁰ In the present study with a big sample size group aimed to provide or ensure the diagnostic malignant breast mass with pattern of blood flow by using gray scale and CDUS comparing with the excised breast mass or pathologically.

METHODS

Study design

This was a cross-sectional diagnostic study conducted between February 2014 and February 2015 at Khon Kaen Hospital.

Patients

All patients with palpable breast masses coming to Department of Surgery, Khon Kaen Hospital were sent for investigation using mammography and gray scale ultrasonography of the breasts. Patients with cystic breast masses from the ultrasonography were sent back to Department of Surgery for aspiration. CDUS was used in case of solid breast mass which latter all solid masses were undergone biopsy and excision.

Diagnostic tools

Gray scale ultrasonography was done with either Toshiba Xario 660 model or Toshiba Apilo 400 model. However, CDUS was performed using only Toshiba Apilo 400 model. All investigations were done by six radiologists with experience in the field more than five years. Findings from gray scale ultrasonography and CDUS were compared against pathological reports.

Statistical analysis

Findings from ultrasonography were reported regarding (i) echogenicity from gray scale alone and (ii) echogenicity in the addition with vascular flow from CDUS. The findings were latter compared with

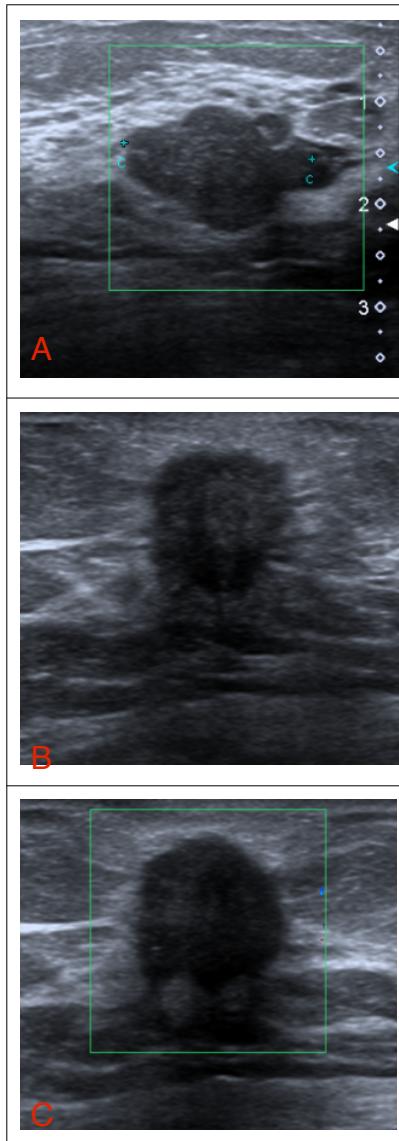


Figure 1: Findings from gray scale ultrasonography with color flow applied in benign breast mass.
 Panel A, an irregular, microlobulated mass (BI-RADS 4). Color Doppler image showing no color flow of the lesion; Panel B and C, an invasive ductal carcinoma recurrence; Panel B, a gray-scale image showing an irregular, speculated mass, architectural distortion, acoustic shadowing, and straightening of Cooper's ligament (BI-RADS 5); Panel C, A color Doppler image showing an avascular lesion.

the pathological report of those with malignancy. The diagnostic properties of the tool were interpreted into sensitivity, specificity and positive predictive value. The chance of having malignancy was also interpreted using Breast Imaging Reporting Data System (BI-RADS™) a quality assurance reporting tool used for mammography reading. The system is a collaborative task of many health professions and it is published and trademarked by the American College of Radiology (ACR).^{1,2}

RESULTS

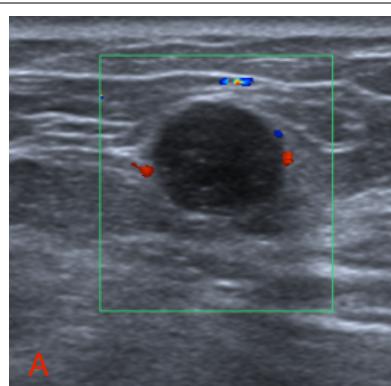
There were 1,438 cases including in the present study. All of them were female with the mean age of 51.4 years old. Of these included 408 case of normal findings from ultrasonography. From pathological reports, 420 were focal cortical dysplasia, 117 were lymph node or lipoma, 68 were complex or complicated cysts.

Findings from the CDUS found 233 solid masses with no vascular flow and all of them were fibroadenoma pathologically. Thirty five cases were suspected of benign solid mass with no flow applied. There were 192 patients that went following up at surgical department after the mammogram and ultrasonography of the breast with suspected malignant breast mass as they showed abnormal echogenicity from gray scale ultrasonography and abnormal vascular flow from CDUS.

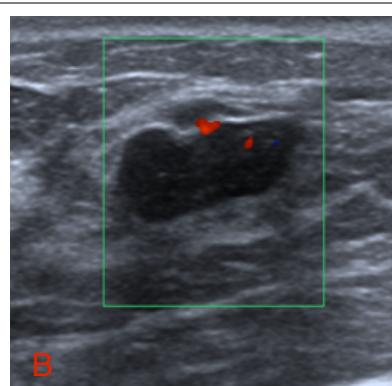
Table 1 shows the diagnostic properties regarding sensitivity, specificity and positive predictive value of findings from gray scale ultrasonography and CDUS. high specificities was observed in when using gray scale ultrasonography only. All of them were more than 80% which went in the opposite direction with sensitivities. It also found that if they vascular flow were exhibited at central together with peripheral of the mass, 100% of the masses would be malignancy. Figure 1 shows findings from gray scale ultrasonography with color flow applied in benign breast mass. No vascular flow is observed in most of the benign lesion. Figure 2 , in contrary, shows findings from gray scale ultrasonography with color flow applied in malignant breast mass. Vascular flow patterns were observed in both at peripheral and central of the mass.

Table 1: Ultrasonographic findings comparing with pathological report of 192 patients with malignancy from pathological reports.

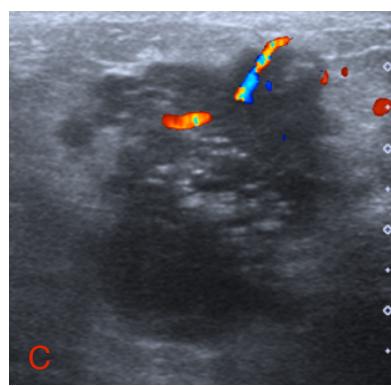
Findings from ultrasonography	Sensitivity (%)	Specificity (%)	Positive predictive value (%)
Gray scale findings			
Speculation	36.6	94.4	91.8
Taller man wick	41.6	98.1	81.2
Angulation	83.2	92.0	67.5
Heteroechoicity	68.8	90.1	60.1
Calcification	27.2	96.3	84.8
Microbulation	79.2	83.8	48.2
Color flow findings			
Flow was exhibited centrally	39.9	80.3	50
Flow was exhibited peripherally	32.8	82.8	97.7
Flow was exhibited centrally and peripherally	47.7	100	100



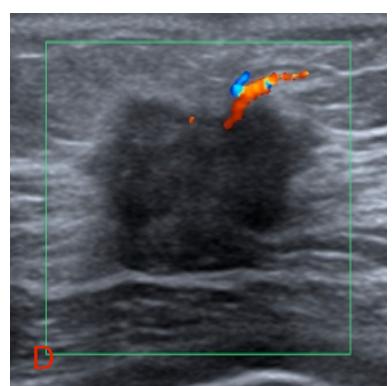
A



B

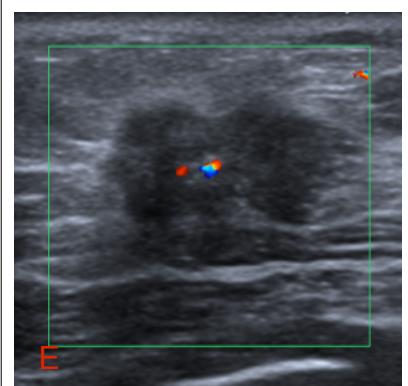


C



D

Figure 2: Findings from gray scale ultrasonography with color flow applied in malignant breast mass.
Panel A&B, a fibroadenocarcinoma : A gray-scale image showing an oval, circumscribed mass (BI-RADS 3). After applying color Doppler image showing a hypervascular lesion with peripheral arteries; Panel C, the intralesional tortuous neovessels variable caliber due to irregular branching strongly increased the suspicious of malignant breast mass; Panel D&E The identification of an indeterminate mass and hypervascular centrally and peripherally (invasive ductal carcinoma).



E

DISCUSSION

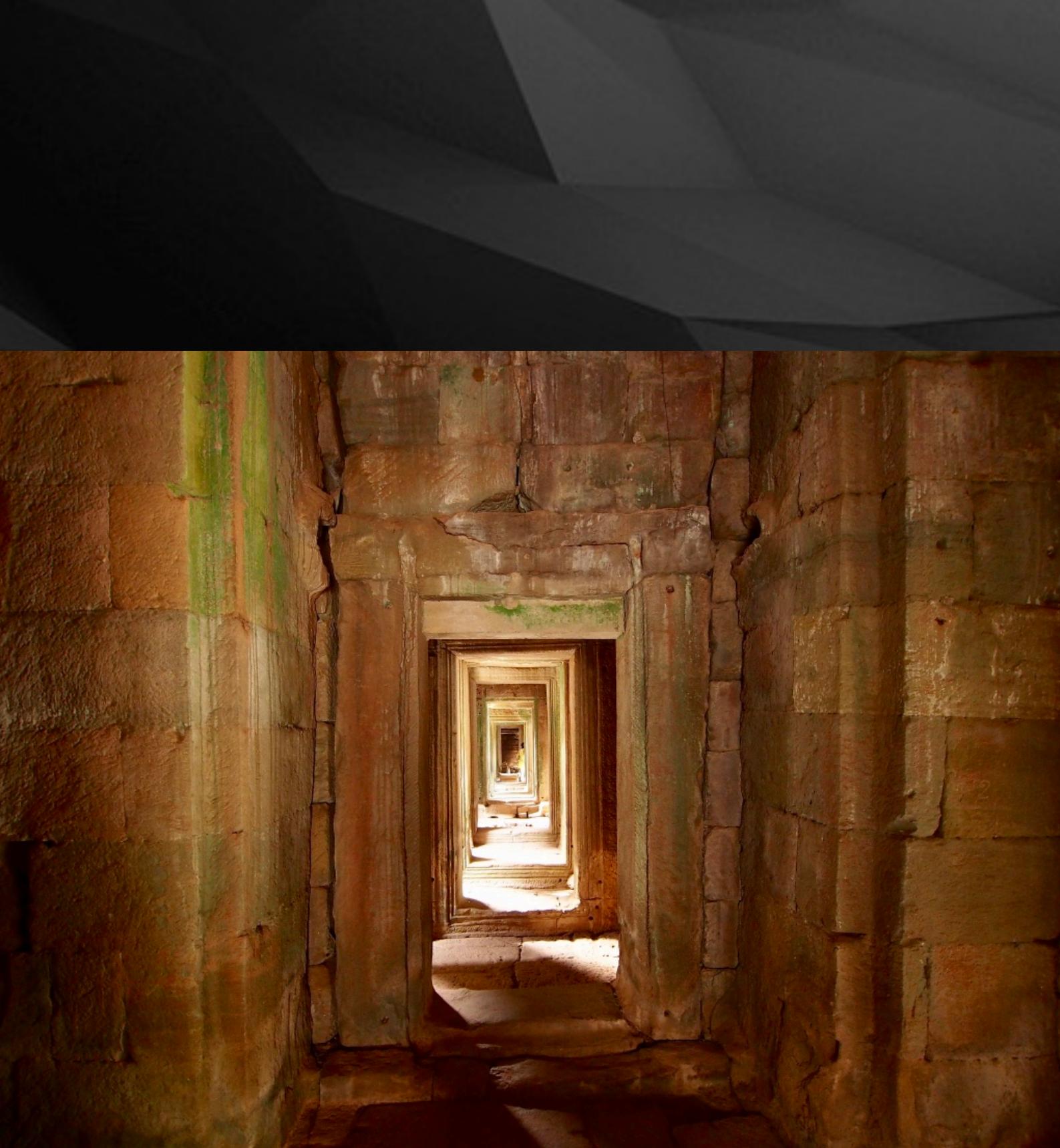
The results showed that if the radiologists use only characteristic of echogenicity of the masses, natures of masses can be identified in most the cases with high specificity. Additionally, with color flow to those breast masses, the radiologists can give the diagnosis or telling more accurate in the nature of those breast masses. As the result, we found that not only the echogenic pattern of the masses, the color flow or vascularity of the lesion was also helped in differentiating the masses. The malignant breast masses usually show abnormal color flow or vascularity of the lesion. If the flow increased only at central area, the sensitivity would not be high while specificity was found to be a bit more than 80%. If the similar pattern was found in the peripheral area, sensitivity was even lower, with a bit higher specificity, and if the flow increased at both regions which is centrally and peripherally the sensitivity would go up to 50% while specificity reached 100%

In conclusion, the results of the present study suggested that if we used only gray scale or β -mode ultrasound in examining breast masses and we apply color flow to the lesion for detecting vascularity. In the combination of both echogenic pattern and CDUS, they both can increase or enhance diagnostically important in distinguishing benign from malignant breast masses at breast ultrasonographic examination.

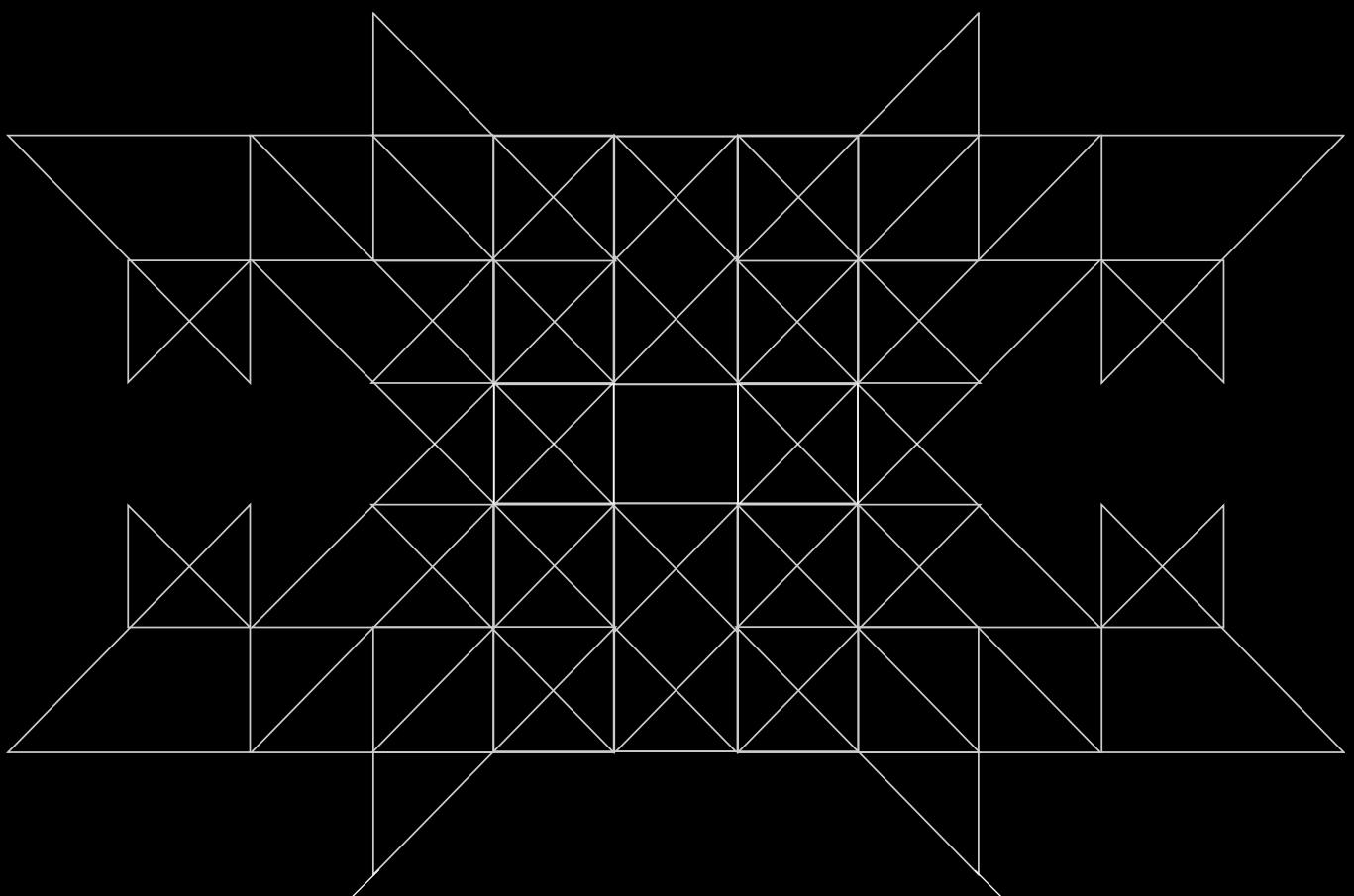
Our results were not against from prior study¹¹ which stated that hyper vascularity of breast mass observed from the CUDS was the most reliable sign in Doppler ultrasound to predict its possibility of malignancy of the breast mass and in another study¹² the authors also suggested that CDUS had been used more in the recent years to differentiate between benign and malignant breast masses which malignant breast masses would have increased vascular or copious blood supply from the CUDS. It can enhance the specificity in telling malignant breast masses up to 100%, if the flow increased centrally and peripherally.

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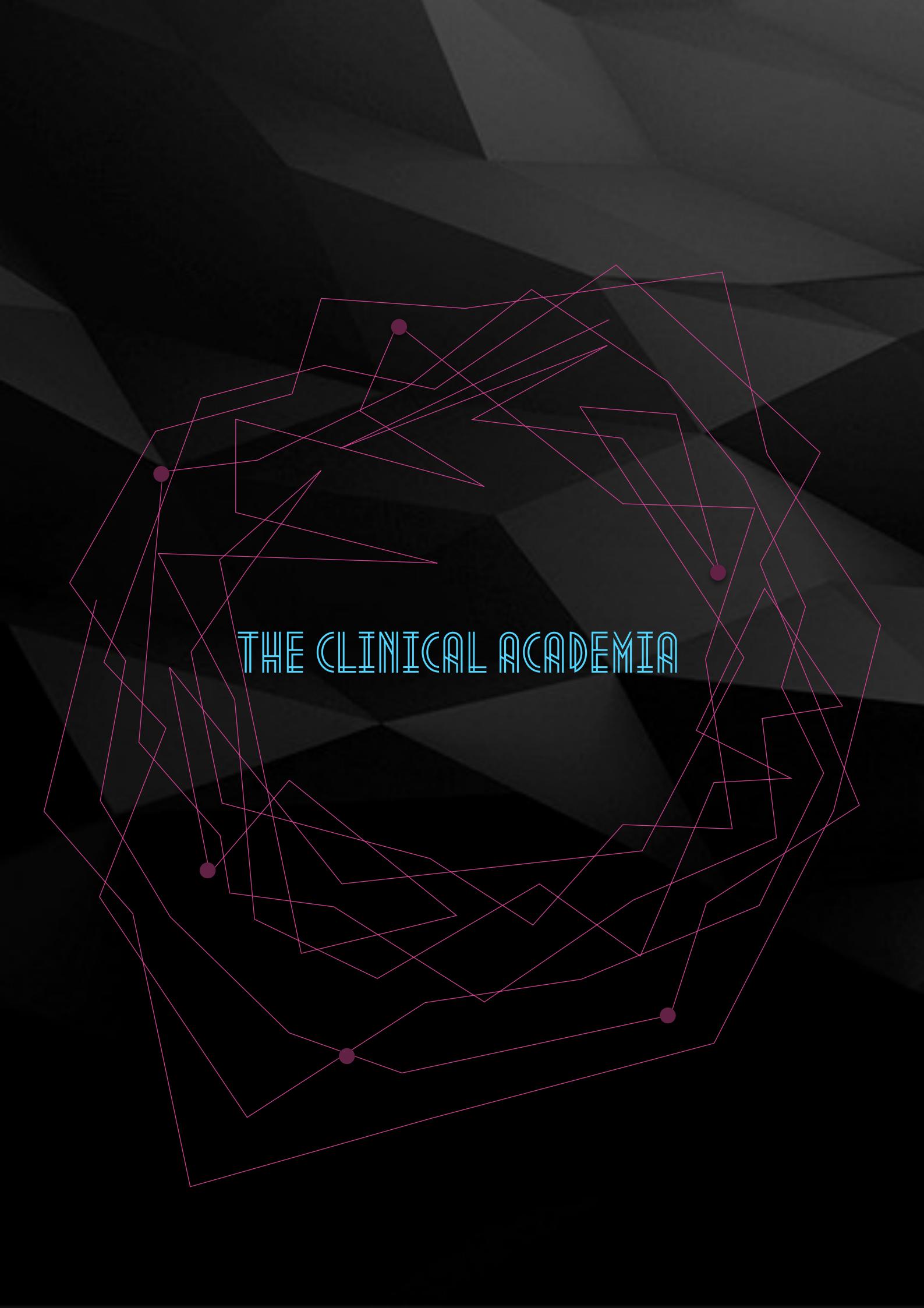


"QUOTE"



"Just do what must be done. This may not be
happiness, but it is greatness."

-George Bernard Shaw



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