



The Thai Journal *of* Orthopaedic Surgery



**The Official Journal of
the Royal College of
Orthopaedic Surgeons of Thailand**

**The Official Journal of Thai Hip & Knee Society
The Official Journal of Spine Society of Thailand
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The Official Journal of Metabolic Bone Disorder and Orthogeriatrics**

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Editorial

The year 2018 is passing very quickly. The JRCOST is about to launch Volume 42, number 1-2 for January-April, 2018. In the change of Orthopaedic training curriculum according to WFME, we hope residents should have their publications more often and being compulsory for every trainee. Apart from residents, we are also trained many fellows in various subspecialties. They should begin with JRCOST and progress to high impact journal for the next step. Nowadays, the medical students are also trying harder to extend their portfolios with publications, and get the well support from all medical schools. We hope the brighter future with our young generation.

In this issue, we have 2 research articles which are “Patterns and Differences of Acetabular Dome Wear of Normal and Operated Hip Joints between the Unipolar and Bipolar Prostheses in the Femoral Neck Fracture Surgery” and “The incidence of Anxiety and Depression in Patients with Spinal Injury at Siriraj Spinal Unit”. We also published 2 case reports. They are “A Case Report of Posterior Shoulder Dislocation with Greater Tuberosity Fracture” and “Anterior Extrusion of Bone Graft after Posterior Lumbar Interbody Fusion with development Deep Vein Thrombosis: Case Report and Literature review”. All of our articles are welcome for comment. Please write a letter to editor. Hope to hear from you.

Pongsak Yuktanandana, MD
Editor, The Thai Journal of Orthopaedic Surgery

Patterns and Differences of Acetabular Dome Wear of Normal and Operated Hip Joints between the Unipolar and Bipolar Prostheses in the Femoral Neck Fracture Surgery

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Purpose: To describe the patterns and differences of wear at acetabular dome wall of the normal and the operated hip joints between the unipolar and bipolar prostheses in the femoral neck fracture surgery.

Patients and Methods: The medical records and radiographic imagings of femoral neck fracture patients who were treated with the unipolar or bipolar prostheses at Maharat Nakhon Ratchasima Hospital since July 2010 to September 2015 were reviewed. The acetabular dome wall thickness (ADWT) was measured on true anteroposterior view of both sides of hip joints at the 1st day and every 6 months after surgery. The measurements were designed with various methods for minimizing the deviation and error and detail would be shown in text below. The patterns and differences of wear at acetabular dome wall between operated side and normal side were described. The patient demographic data and the wear at acetabular dome wall were compared between the unipolar and bipolar prostheses groups. A p-value of less than 0.05 was considered statistically significant.

Results: All 152 patients were classified into 83 with unipolar and 69 with bipolar prostheses groups. The wear pattern at acetabular dome wall on the normal side was not significantly different in both groups. After sex, ADWT on the operated side at 1 day after surgery and age groups adjusted, the wear differences between two groups were statistically significant at 6, 12, 24, and 30 months after surgery with mean differences of 0.307, 0.609, 0.825, and 2.460, respectively.

Conclusion: The wear patterns at acetabular dome wall in femoral neck fracture surgery were different between the unipolar and bipolar prostheses. They were statistically significant only at 6, 12, 24, 30 months after surgery.

Keywords: Wear at acetabular dome wall, Unipolar prosthesis, Bipolar prosthesis, Femoral neck fracture

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Introduction

Unipolar and bipolar prostheses are instruments which have been widely used in hemiarthroplasty surgical procedure, for treating the femoral neck fractures in older patients. There are many documents demonstrating that bipolar hemiarthroplasty will reduce the forces that transmit to acetabular cartilage surface and decrease wear at acetabulum wall as compared with unipolar hemiarthroplasty^(1,2). And some researchers show that the unipolar hemiarthroplasty group has wear rate at acetabulum wall more than the bipolar hemiarthroplasty group⁽¹⁻⁷⁾. But both prosthesis designs have equally hip functional outcome, so in the older patients, the unipolar hemiarthroplasty should be preferred due to its lower cost⁽¹⁻⁶⁾.

Most researchers stated about acetabular erosion rate of the patients who received surgery as

well as the revision rate from protrusion of acetabulum^(7,11,14,17). Nevertheless, no study has shown the information about the pattern and differences of wear at acetabular dome between the unipolar and bipolar prostheses after the femoral neck fracture surgery in any interval of follow up and no study shows how to measure the wear of acetabular dome wall, either.

The purpose of this study is to demonstrate the patterns and differences of acetabular dome wear between the unipolar and the bipolar prostheses in the femoral neck fracture surgery, reference with the contralateral intact acetabular dome wall thickness in different times of follow up after surgery.

Patients and Methods

The medical records of patients who were admitted at Maharat Nakhon Ratchasima Hospital with femoral neck fractures and surgically treated with the unipolar or the bipolar prostheses between July 2010 and September 2015 were collected from the hospital's database. The radiographic imagings of both hips in anteroposterior view (AP) were

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concurrently reviewed. The radiographic images which were not clearly sharp, blurred, not in true AP view of which coccyges were not in the mid to pubic symphysis or lacked of follow up images at 6 months after surgery were excluded. The measurements were done preoperatively on both sides of hip joints. Postoperative measurements were done on day 1 and every 6 months after surgery on both normal and operated sides. All images were magnified at full screen before measurement to decrease the errors. Acetabular dome wall thickness was measured from tip of femoral head prosthesis directly to the center of the acetabular dome in millimeters with two decimal points (Figure 1). The films were measured in the first round and left for 1 week before starting to measure them again in the second round with blindness in results of the first round and were done in the same manner in the third round with blindness in results of the first and second rounds also. All patients' profile and measurement data were collected for statistical analysis.

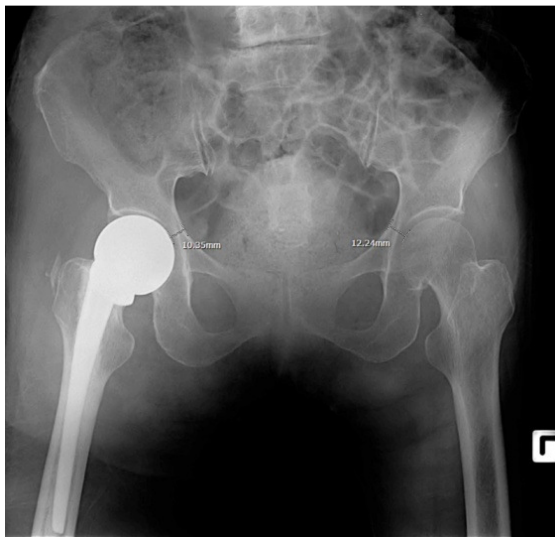


Fig.1 Acetabular dome wall thickness measurement on radiography

Results

One hundred and fifty-two patients were included, 83 were allocated into the unipolar prosthesis group and the rest (69) were in the bipolar group. The mean age was 82.35 years in the unipolar group which was higher than 73.14 years of the bipolar group with statistical significance ($P < 0.001$). But when they were grouped according to age group: less than 75, 75-84 and ≥ 85 years, there were no differences between two groups. All measurements were performed by the first author only for the avoidance of the inter-observer variation of the measurement. The follow up periods were 6 and 36 months after surgery in both groups.

Table 1 showed demographic data that the unipolar and bipolar groups had no statistically significant differences in sex, underlying diseases: hypertension, diabetes mellitus, chronic kidney disease, ASA Classification and radiographic imaging for acetabular dome wall thickness at the normal and operated sides at 1 day after surgery.

Data analysis

The frequency distributions of demographic characteristics and medical histories of the unipolar and bipolar prostheses groups were expressed as means and standard deviation for continuous variables and counts and percentages for categorical variables. The Fisher's exact test and Student T test were used to analyze the bivariate differences for categorical and continuous variables, respectively. To estimate differences of acetabular dome wear between the unipolar and bipolar prostheses in femoral neck fracture surgery, linear regression procedures were performed to estimate the mean differences and confidence intervals (95 % CI) after adjusted for potential confounding factors. All reported p-values were two tailed, and confidence intervals were calculated at the 95 % level.

On the normal side of the unipolar group, there was loss of acetabular dome wall thickness firstly at 24 months after surgery with little wear at 30 months. At 36 months after surgery, the pattern showed that they looked like no further wear but some data were lost during follow up. This may disturb the conclusion of the direction of wear at acetabular dome wall. For the bipolar group, the pattern of wear at acetabular dome wall appeared in every follow-up until 36 months after surgery with a slower rate compared with the unipolar group.

On the operated side, patterns of wear at acetabular dome wall both in the unipolar and bipolar groups looked similar. The loss firstly started at the 30 months after surgery with a slightly slower rate of loss at 18 months. The pattern at 36 months showed that they looked like no further loss but the amount of data were less than those in the earlier follow-up which might disturb the results for concluding the direction of wear at acetabular dome wall. The severity of wear in the bipolar group was less than in the unipolar group.

After sex, ADWT on the operated side at 1 day after surgery and age groups were adjusted, comparison between the unipolar and bipolar groups as described in table 2, there were statistically significant differences at 6, 12, 24, 30 months after surgery with 95 % CI but no statistically significant differences at 18 and 36 months.

Table 1 Demographic data

Factors	Unipolar Prosthesis (n=83)		Bipolar Prosthesis (n=69)		P-value
	Mean (SD)	No (%)	Mean (SD)	No (%)	
Female		69 (83.13)		58 (84.06)	1.000
Age, year					< 0.001
< 75		6 (7.2)		31 (44.9)	
75-84		45 (54.2)		32 (46.4)	
≥85		32 (38.6)		6 (8.7)	
Hypertension		33 (39.8)		30 (43.5)	0.74
Diabetes mellitus		10 (12.0)		14 (20.3)	0.19
Chronic kidney disease		5 (6.0)		4 (5.8)	1.000
ASA Classification					0.08
Class 1		5 (6.0)		8 (11.6)	
Class 2		32 (38.6)		35 (50.7)	
Class 3		43 (51.8)		26 (37.7)	
Class 4		3 (3.6)		0 (0.0)	
ADWT on normal side*	12.76 (2.55)		12.71 (1.75)		0.90
ADWT on operated side *	10.57 (2.54)		10.40 (2.14)		0.67

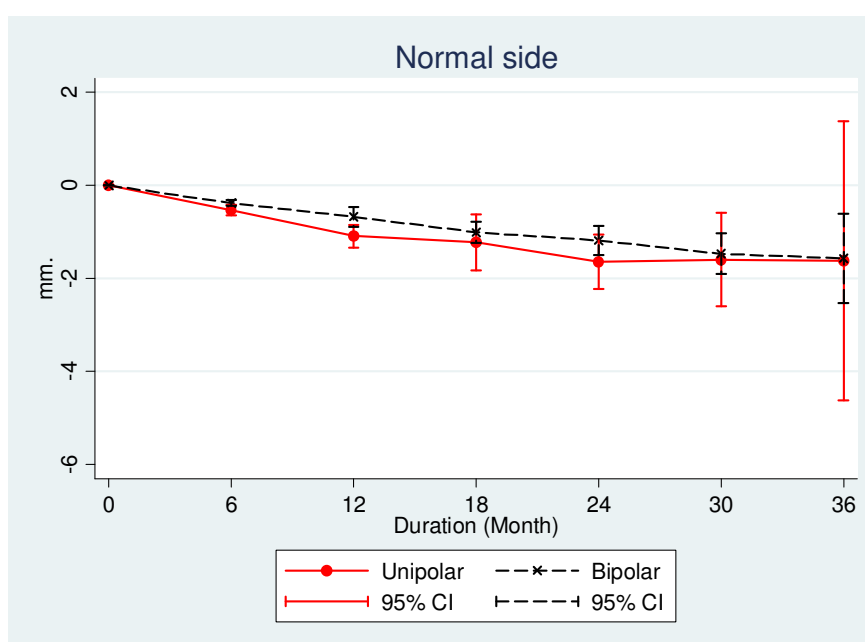
ADWT = acetabular dome wall thickness

*on day 1 after surgery

Table 2 Wear differences between the unipolar and the bipolar groups at acetabular dome wall in each follow up time after surgery

Duration after surgery (Months)	Mean wear difference* (mm.)	95% CI
6	0.307	0.043, 0.570
12	0.609	0.308, 1.187
18	0.542	- 0.110, 1.194
24	0.825	0.091, 1.558
30	2.460	0.420, 4.505
36	0.219	-1.519, 2.010

Note:* – adjust for sex, ADWT on operated side at 1 day after surgery and age groups

**Fig.2** Patterns of wear at acetabular dome wall on normal side

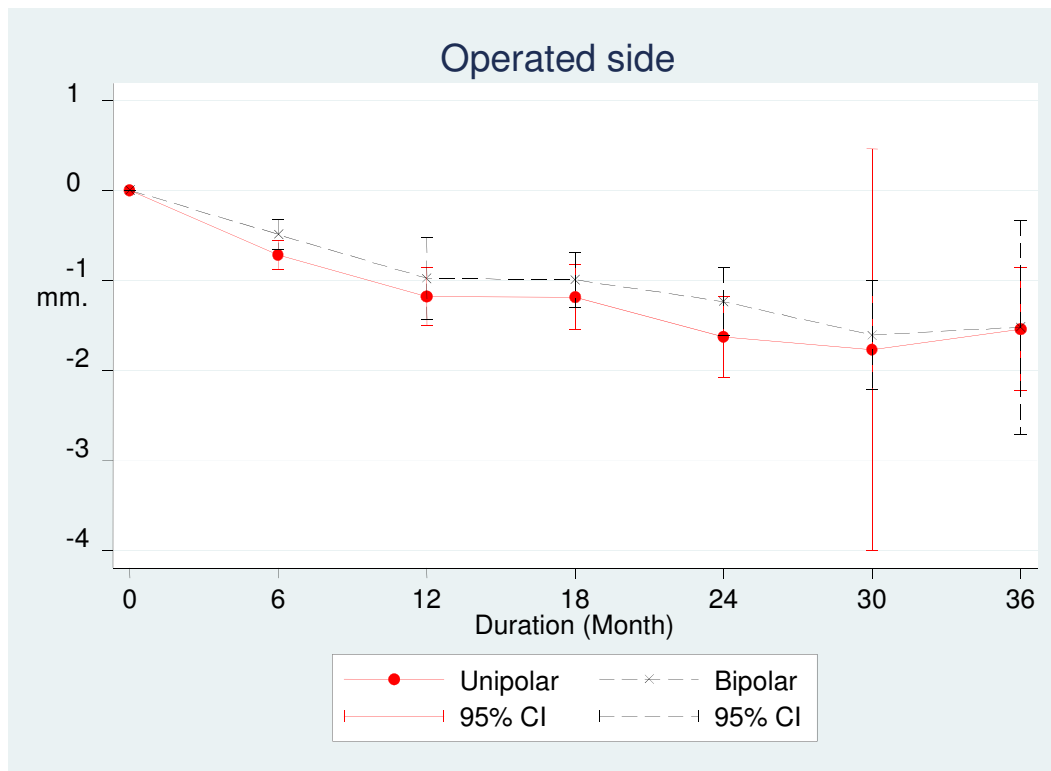


Fig.3 Pattern of wear at acetabular dome wall on the operated side

Discussion

The mean age in the unipolar group was higher than that in the bipolar group with statistical significance (P -value <0.001) but when the patients were classified into subgroups for age: <75 , 75 - 84 and ≥ 85 years, there were no statistically significant differences between the unipolar and bipolar groups. This may explain why many researchers show good or better results in the patients who undergo the surgery using the bipolar prosthesis compared with the unipolar groups especially in the aspect of the acetabular erosion rate and the revision rate which are higher in the latter group⁽¹⁻⁷⁾. Most of orthopedic surgeons prefer using the bipolar prosthesis in the younger patients who may live longer with no complications while the unipolar prosthesis that has lower cost is preferably chosen for the older patients who may not live longer.

Dalldorf et al⁽⁸⁾ showed no statistically significant difference in the cartilage wear between the unipolar and the bipolar components. According to them, the severity of the degeneration correlated directly with the duration of articulation of the implant with the acetabulum and the loss of radiographic joint space closely correlated with the deterioration of the histological grade of the acetabular cartilage.

Kanto⁽⁹⁾ analyzed radiographs in 147 patients; 72 in the bipolar and 75 in the unipolar

groups, at the initial post-operation and one year after operation. The rate of acetabular erosion was measured and found that early protrusion was equal in both groups. Khan et al⁽¹⁰⁾ found two patients who were symptomatic with acetabular protrusion occurring at a mean of 5.6 years after the procedure.

In the unipolar group, the wear pattern at acetabular dome wall on normal side was firstly recognized at 24 months after surgery but less wear at 30 months. Comparing with the bipolar group, there were no statistically significant differences at any follow up duration after surgery. These results showed that no statistical significant differences in the patterns and the severity of the wear at acetabular dome wall on normal sides after surgery at least about 30 months. Data after 30 months should be further collected to evaluate the pattern and the severity of the wear at acetabular dome wall in the long run.

On the operated side, the wear pattern at acetabular dome wall both in the unipolar and bipolar groups looked similar, viz., the loss firstly started at the 30 months after surgery with a slightly slower rate of loss at 18 months. The wear pattern at 36 months showed that they looked like no further loss. However because of the inadequate amount of data in longer follow up period, it might disturb the conclusion of the direction of the wear at acetabular dome wall. In the bipolar group, the

pattern of wear looked nearly similar to those of the unipolar group but had less degree of the wear.

It was found that the longer time after the operation, the wear at the acetabular dome wall was more severe. However the mean differences of the wear had slightly slower rate at 18 and 36 months without statistical significance. At 30 months after surgery, mean difference of the wear was 2.46 millimeters which was very striking. If the data after 30 months could be collected with adequate amount, there would be more information to be analyzed and the trend of the wear's pattern and mean differences of the wear could be summarized.

When our data were interpreted, there were several points being considered. First, there were some patients who lost to follow up due to many reasons such as the unaffordable fee for transportation to the hospital, the difficulty in travel from remote rural area to the hospital, the unavailable time of care givers to transfer the patients on the follow up day, etc. The tracking data at each visit of follow- up, 6-36 months in the unipolar prosthesis group were 64, 27, 20, 16, 10 and 5 whereas in the bipolar prosthesis group were 61, 39, 13, 12, 4 and 4.

All patients who received surgery should avoid the weight bearing on ambulation after surgery for some time interval, depending on the situation of the patients and the opinion of the surgeons. If the duration of time for avoidance of the weight bearing of the patients can be extended to at least 6-12 months after surgery, there may be some benefit to lessen the severity of the wear in acetabular dome wall on the operated side. This should be verified in the further study. And it is true, it will be helpful to change the clinical practice in the future.

So far there has never been study showing the information about the patterns and differences of the wear at acetabular dome wall thickness comparing between the unipolar and bipolar prostheses after the femoral neck fracture surgery in each period of time like this study before. The more proper design to allocate patients, the longer time of follow up, a large number of radiographic imagings from the patients may be helpful to clarify this topic.

Conclusion

The wear pattern at acetabular dome wall in the femoral neck fracture after surgery was different between the unipolar and the bipolar prostheses. The wear differences were statistically significant only at 6, 12, 24, 30 months after surgery.

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Potential conflicts of interest

None.

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รูปแบบและความแตกต่างของการสีกที่ผนังส่วนบนสุดของ *Acetabulum* ข้างปกติและข้างผ่าตัดเปรียบเทียบระหว่างการผ่าตัดด้วยการใส่ข้อสะโพกเทียมแบบเบ้าหนึ่งชั้นและสองชั้นในผู้ป่วยที่กระดูกแตกหักบริเวณสะโพก

สุรัตน์ ส่งวิรุพท์, พบ, มนูญ เลียวนรเศรษฐ์, พบ

วัตถุประสงค์: ศึกษารูปแบบและความแตกต่างของการสีกที่ผนังส่วนบนสุดของ *Acetabulum* ข้างปกติและข้างผ่าตัดเปรียบเทียบระหว่างการผ่าตัดด้วยการใส่ข้อสะโพกเทียมแบบเบ้าหนึ่งชั้นและสองชั้น ในผู้ป่วยที่กระดูกแตกหักบริเวณสะโพก

ผู้ป่วยและวิธีการ: เวชระเบียนของผู้ป่วยที่มีการแตกหักบริเวณคอกระดูกต้นขา ซึ่งได้รับการผ่าตัดด้วยการใส่ข้อสะโพกเทียมแบบเบ้าหนึ่งชั้นและสองชั้น และฐานข้อมูลภาพเอกซเรย์ที่โรงพยาบาลมหาสารคามระหว่างเดือนกรกฎาคม ค.ศ. 2010 ถึง เดือนกันยายน ค.ศ. 2015 จำนวน 152 ราย ได้รับการทบทวน การวัดความหนาที่ส่วนบนสุดของ *Acetabulum* ถูกออกแบบด้วยวิธีการหลายอย่างในการควบคุมความเบี่ยงเบนและความผิดพลาดซึ่งแสดงรายละเอียดไว้ในรายงานการศึกษา โดยวัดทั้งข้างปกติและข้างผ่าตัดที่ 1 วันหลังผ่าตัดและทุกๆ ช่วง 6 เดือนหลังผ่าตัด

ผลการศึกษา: มีผู้ที่ผ่าตัดใส่ข้อสะโพกเทียมแบบเบ้าหนึ่งชั้น 83 ราย และแบบสองชั้น 69 ราย รูปแบบการสีกของผนังส่วนบนสุดของ *Acetabulum* ข้างปกติ ไม่พบความแตกต่างอย่างมีนัยสำคัญทางสถิติทั้งกลุ่มที่ผ่าตัดด้วยข้อสะโพกเทียมแบบเบ้าหนึ่งชั้นและสองชั้น เมื่อทำการปรับด้วยเพศ, ข้างผ่าตัด 1 วันหลังผ่าตัด และอายุ พบว่ามีความแตกต่างอย่างมีนัยสำคัญทางสถิติที่ 6, 12, 24, 30 เดือนหลังผ่าตัดที่ 0.307, 0.609, 0.825 และ 2.460 ตามลำดับ ในขณะที่ไม่มีความแตกต่างอย่างมีนัยสำคัญทางสถิติที่ 18 และ 36 เดือนหลังผ่าตัดที่ 0.542 และ 0.219 ตามลำดับ

สรุป: รูปแบบของการสีกที่ผนังส่วนบนสุดของ *Acetabulum* เปรียบเทียบระหว่างการผ่าตัดด้วยการใส่ข้อสะโพกเทียมแบบเบ้าหนึ่งชั้นและสองชั้น ในผู้ป่วยที่มีกระดูกแตกหักบริเวณสะโพกมีความแตกต่างอย่างมีนัยสำคัญทางสถิติในข้างที่ผ่าตัด ค่าเฉลี่ยความแตกต่างของการสีกมีความแตกต่างอย่างมีนัยสำคัญทางสถิติที่ระยะเวลา 6, 12, 24, 30 เดือนภายหลังการผ่าตัด

The incidence of Anxiety and Depression in Patients with Spinal Injury at Siriraj Spinal Unit

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Objective: To investigate the incidence of anxiety and depression among patients with spinal injury admitted to the Siriraj Spinal Unit, and to compare depression and anxiety scores between admission and discharge. We also evaluated for factors that significantly associate with unimproved anxiety and depression score.

Methods: This prospective study included patients with spinal injury that were admitted to the Siriraj Spinal Unit of Siriraj Hospital during December 2013 to August 2017. Presence and level of anxiety and depression were assessed using Thai Hospital Anxiety and Depression Scale (Thai HADS). The following data were collected: age, gender, education level, marital status, occupation, diagnosis, level of impairment, injury severity, cause of injury, and length of stay.

Results: Ninety patients were included, with a mean age of 44.4 ± 16.7 years. There were 68.9% males and 31.1% females. The incidence of anxiety and depression on the day of admission was 8.9% and 7.8%, respectively, with decreases to 4.4% and 5.6% before discharge (Table 2). Mean HADS score for anxiety decreased from 6.1 ± 3.2 to 3.2 ± 2.9 , and for depression from 5.1 ± 3.4 to 3.0 ± 3.1 . In multivariate analysis, age and marital status were significantly associated with unimproved depression score ($P=0.003$ and $P=0.025$, respectively). No evaluated factors were significantly associated with unimproved anxiety score.

Conclusion: The incidence of anxiety and depression decreased from 8.6% and 7.8% to 4.4% and 5.6%, respectively, compared between admission and discharge. Age and marital status were significantly associated with unimproved depression score, while no factors were able to significantly predict unimproved anxiety score.

Keywords: Thailand, anxiety, depression, spinal injury

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Introduction

Patients with spinal cord injury suffer acute and catastrophic change in physical condition and ability that can lead to anxiety, despair, hopelessness, insecurity, uncertainty, pessimism, low self-esteem, and depression^(1,2). These emotional outcomes of spinal injury can also lead to poor cooperation with rehabilitation and occupational therapy during admission. Wattanapan, et al.⁽³⁾ reported a prevalence of depression in spinal injury patients of 5.6% using Thai HADS. Many studies from other countries reported a rate of 13% for anxiety and 16% for depression⁽⁴⁾. Carvalho, et al.⁽⁵⁾ found that 60% of patients had depression after spinal injury when tested with the Symptom-Checklist-90-Revised

(SCL-90-R) questionnaire. The prevalence of anxiety was 10-12% in a study from Royle, et al.⁽⁶⁾

The quality of medical care and rehabilitation also affects the level of anxiety and depression in this patient population. Mehaidat, et al.⁽⁷⁾ conducted a study in paraplegia patients and found 28.2% anxiety and 17.4% depression during acute care, which decreased significantly to 18.1% and 11.5%, respectively, after rehabilitation. Kuptniratsaikul, et al.⁽⁸⁾ reported a prevalence of anxiety and depression after the injury of 18.2% and 13.6%, respectively, which decreased to 13.6% and 2.3% after receiving medical care, though both changes failed to achieve statistical significance due to the small size of the study population.

The Siriraj Spinal Unit was the first spine-specific center for treating spinal trauma in Southeast Asia, with a multidisciplinary team that provides international standard quality medical and rehabilitation care. However, the incidence of anxiety and depression among spinal injured patients treated at the Siriraj Spinal Unit is not known.

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Accordingly, the aim of this study was to investigate the incidence of anxiety and depression among patients with spinal injury who were admitted to the Siriraj Spinal Unit, and to compare depression and anxiety scores between admission and discharge. We also evaluated for factors that significantly associate with unimproved anxiety and depression score.

Methods

Participants

This prospective study included patients with spinal injury that were admitted to the Siriraj Spinal Unit of Siriraj Hospital during the 19 December 2013 to 28 August 2017 study period. Siriraj Hospital is Thailand's largest national tertiary referral center. Patients that satisfied all of the following criteria were included: (1) age more than 18 years during admission; (2) having good consciousness; and, (3) having good ability and willingness to answer the HADS questionnaire. Patients meeting one or more of the following were excluded: (1) history of diagnosed psychological diseases, such as schizophrenia, depressive disorder, and/or anxiety before being admitted to the Siriraj Spinal Unit; and, (2) history of underlying disease(s) that adversely affect the thinking process or the emotions, such as Alzheimer's disease, Parkinson's disease, cerebrovascular disease, head injury, HIV infection, epilepsy, and/or substance use (e.g., alcoholism, illegal or prescription drug abuse, inhalants).

Assessment instrument

Presence and level of anxiety and depression were assessed using the Thai Hospital Anxiety and Depression Scale (Thai HADS). Thai HADS is a widely used and reliable tool for screening for clinical anxiety and depression. There are seven items for each of the two parameters, and each item is scored using a 4 point Likert scale (0-3), with a 0 indicating the lowest level of agreement and a 3 indicating the highest level of agreement. The highest achievable number of points is 21 for both anxiety and depression. Persons scoring 0 to 7 are regarded as non-cases, 8-10 are regarded as possible cases, and 11-21 are considered probable cases. In this study, patients scoring more than 7 on either scale were considered as having anxiety and/or depression.

Procedure

After receiving study approval from the Siriraj Institutional Review Board (SIRB), Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand (COA no. 637/2556, EC4), written informed consent was obtained from all enrolled study participants. The following data were collected from patient medical records: age, gender, education level, marital status, occupation,

diagnosis, level of impairment, severity of injury, cause of injury, and length of stay. Patient level of anxiety and depression was assessed using Thai HADS at both admission and at discharge.

Statistical analysis

Sample size calculated by using the prevalence of anxiety and depression after the injury from Kuptniratsaikul, et al.'s⁽⁸⁾ study which was 18.2% with the allowable error of 0.08%, two-sided level of significance (alpha error) was set of 5%. The estimated sample size was at least 90 patients. All data analyses were performed using SPSS Statistics version 18 (SPSS, Inc., Chicago, IL, USA). Demographic data were interpreted using descriptive statistics. Data are reported as number and percentage or mean \pm standard deviation. HADS scores between admission and discharge were compared using paired t-test. Chi-square test and Fisher's exact test were used for multivariate risk factor analysis. A p-value less than 0.05 was regarded as being statistically significant.

Results

Ninety patients were included in this study. The mean age of patients was 44.4 \pm 16.7 years (range: 18-76), with a gender distribution of 68.9% males and 31.1% females. Just over half of patients (52.2%) were married. Most patients had at least a secondary school education (31.1%) and worked as an employee (35.6%). The most common cause of injury was falls (50%). The proportion of paraplegia and tetraplegia was equal (34.4%), and most of those patients sustained incomplete spinal cord injury (46.7%). The mean length of stay was 34.3 \pm 25.2 days (range: 10-146) (Table 1).

The incidence of anxiety and depression on the day of admission was 8.9% and 7.8%, respectively, with decreases to 4.4% and 5.6% before discharge (Table 2). Mean HADS score for anxiety decreased from 6.1 \pm 3.2 to 3.2 \pm 2.9, and for depression from 5.1 \pm 3.4 to 3.0 \pm 3.1.

Nineteen patients (21.1%) had unimproved anxiety score, and 29 patients (32.2%) had unimproved depression score. In multivariate analysis, age and marital status were found to be significantly associated with unimproved depression score ($P=0.003$ and $P=0.025$, respectively). No evaluated factors were significantly associated with unimproved anxiety score. Almost half (47.6%) of patients aged less than 45 years had unimproved depression score, while that proportion was only 18.7% of patients in the ≥ 45 year age group. The proportion of patients with unimproved depression score was higher in single patients (44.2%) than in married patients (21.0%).

Discussion

Thai HADS is a widely used and reliable measure for screening the probable presence and severity of clinical anxiety and depression in Thai patients admitted in the hospital. Thai HADS was shown to have a high sensitivity and specificity for diagnosis of these disorders⁽⁹⁾. In this study, the incidence of anxiety and depression, which was defined as patients with a score > 7 from self-reporting via the Thai HADS questionnaire, was 8.9% and 7.8% at admission. This finding was similar to the 5.6% prevalence of depression among spinal injury patients using Thai HADS reported by Wattanapan, et al. However, studies from the UK and Western Europe reported much higher levels of anxiety (19-35%) and depression (17-27%) among spinal injury patients, and these studies also used the HADS assessment tool^(10,11). This disparity in the prevalence of anxiety and depression among studies may be attributed to Thai cultural mores⁽¹²⁾, which include living with and the importance of extended family, which provides adequate social support, and if a family member becomes the primary caregiver, the patient tends to have better quality of life⁽¹³⁾. A 2010 study reported lack of social support, such as good social relationships and help from family, to be a risk factor for depression in patients with spinal cord injury⁽¹⁴⁾.

The incidence of anxiety and depression in this study decreased when compared between admission and discharge (Table 2), which was consistent with the findings of an earlier study by Mehaidat, et al.⁽⁷⁾ that found that the presence of anxiety and depression in paralyzed patients in Jordan decreased significantly at the end of the rehabilitation program (28.2% to 18.1% for anxiety, and 17.4% to 11.5% for depression). Kuptniratsaikul, et al.⁽⁸⁾ also reported decreased anxiety from 18.2% to 13.6% and decreased depression from 13.6% to 2.3% in spinal cord injury patients. The findings of this study demonstrate the effectiveness of the patient counseling service provided by the psychologist that is part of our multidisciplinary team of caregivers at the Siriraj Spinal Unit. Our psychologist regularly accesses the mental health status of both patients and caregivers, and encourages patients to actively participate in the prescribed rehabilitation program. Our staff psychologist also evaluates the mental health status of our patients before discharge, which helps to preventing the development of anxiety and depression in the future.

Regarding the group of patients in this study with unimproved anxiety and depression score, we found no factors that significantly related to the anxiety group, but age and marital status significantly related to the depression group. Earlier study in the US⁽¹⁵⁾ found younger age (25-49 years) to be a risk factor for depression in

patients with spinal cord injury. Bombardier, et al.⁽¹⁶⁾ found that the severity of depression increased in 20-29 year-old patients, which is consistent with the finding of this study that a higher proportion of patients younger than 45 years old had unimproved depression score. In contrast, Wattanapan, et al.⁽³⁾ found no significant relationship between age and depression. Similar to the finding of our study, Bombardier, et al.⁽¹⁴⁾ found marital status to be one of the demographic factors that had an effect on the prevalence of depression in spinal cord injury. In the present study, we found a higher incidence of depression among single patients, which was consistent with a 1998 study that found that patients with maladjusted marital status had a higher rate of depression⁽¹⁷⁾. A study by Tate, et al.⁽¹⁸⁾ reported that loss of a spouse significantly associated with depressive symptoms in spinal cord injury patients.

The limitation of this study is the small number of patients, which prevented us from employing multiple logistic regression for multivariable analysis to identify correlations between demographic factors and patients with unimproved anxiety and depression score. Regarding the preceding paragraph, the descriptions in Table 4.

Conclusion

The incidence of anxiety and depression decreased from 8.6% and 7.8% to 4.4% and 5.6%, respectively, compared between admission and discharge. Age and marital status were the only two factors significantly associated with unimproved depression score, while no factors were able to significantly predict unimproved anxiety score. The results of this study support the efficacious role of patient counseling services at the Siriraj Spinal Unit.

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Conflict of interest declaration

The authors hereby declare no personal or professional conflicts of interest regarding any aspect of this study.

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None

Table 1 Demographic and clinical characteristics of patients with spinal injury

Variables	Mean
Age (years) (mean (SD))	44.4 (16.7)
Gender Male/Female	62/28 (68.9/31.1)
Education	
- No	2 (2.2)
- Primary school	24 (26.7)
- Secondary school	28 (31.1)
- Vocational certificate	10 (11.1)
- Undergraduate	21 (23.3)
- Postgraduate	5 (5.6)
Marital status	
- Single	43 (47.8)
- Married	47 (52.2)
Occupation	
- No	6 (6.7)
- Student	7 (7.8)
- Employee	32 (35.5)
- Government officer	8 (8.9)
- Office worker	4 (4.4)
- Business	14 (15.6)
- Agriculturist	14 (15.6)
- Retire	5 (5.6)
Cause of injury	
- Traffic accident	42 (46.7)
- Falls	45 (50.0)
- Violence	2 (2.2)
- Other	1 (1.1)
Level of impairment	
- Normal	28 (31.2)
- Paraplegia	31 (34.4)
- Tetraplegia	31 (34.4)
Severity of injury (n=62)	
- Complete	20 (22.2)
- In Complete	42 (46.7)
length of stay (mean (SD))	34.4 (25.2)

Table 2 Incidence of anxiety and depression on admission and before discharge Assessment

Measure	On admission (N=90)		Before discharge (N=90)	
	N	%	N	%
HADSa	8	8.9	4	4.4
HADSd	7	7.8	5	5.6

Abbreviations: HADSa, Thai Hospital Anxiety and Depression Scale-anxiety subscale; HADSd, Thai Hospital Anxiety and Depression Scale-depression subscale

Table 3 Mean anxiety and depression scores on admission and before discharge

Measure	On admission (N=90)		Before discharge (N=90)		P-value
	Mean	SD	Mean	SD	
HADSa	6.1	3.2	3.2	2.9	<0.001*
HADSd	5.1	3.4	3.0	3.1	<0.001*

A P-value<0.05 indicates statistical significance

Abbreviations: HADSa, Thai Hospital Anxiety and Depression Scale-anxiety subscale; HADSd, Thai Hospital Anxiety and Depression Scale-depression subscale

Table 4 Univariable analysis of the demographic factors in patients with unimproved anxiety score

	Improved anxiety score (N=71)	Unimproved anxiety score (N=19)	P-value
Gender			1.000
male	49 (79.0%)	13 (21.0%)	
female	22 (78.6%)	6 (21.4%)	
Age (years)			0.379
< 45	31 (73.8%)	11 (26.2%)	
≥ 45	40 (83.3%)	8 (16.7%)	
Education			0.570
Lower Bachelor's Degree	49 (76.6%)	15 (23.4%)	
Bachelor's Degree and higher	22 (84.6%)	4 (15.4%)	
Marital status			0.797
Single	33 (76.7%)	10 (23.3%)	
Married	38 (80.9%)	9 (19.1%)	
Occupation			1.000
Without income/salary	14 (77.8%)	4 (22.2%)	
income/salary	57 (79.2%)	15 (20.8%)	
Cause of injury			0.810
Fall	34 (75.6%)	11 (24.4%)	
Traffic accident	34 (81.0%)	8 (19.0%)	
Violence	2 (100.0%)	0 (0.0%)	
Other	1 (100.0%)	0 (0.0%)	
Level of impairment			0.382
Paraplegia	22 (71.0%)	9 (29.0%)	
Tetraplegia	25 (80.6%)	6 (19.4%)	
Normal	24 (85.7%)	4 (14.3%)	
Severity of injury			0.209
Complete	13 (65.0%)	7 (35.0%)	
Incomplete	34 (81.0%)	8 (19.0%)	
Normal	24 (85.7%)	4 (14.3%)	
Length of stay (days)			0.426
< 30	25 (73.5%)	9 (26.5%)	
≥ 30	46 (82.1%)	10 (17.9%)	

P-value were for the Chi-square test and Fisher's exact test
A P-value<0.05 indicates statistical significance

Table 5 Univariable analysis of the demographic factors in patients with unimproved depression score

	Improved depression score (N=61)	Unimproved depression score (N=29)	P-value
Gender			0.638
male	41 (66.1%)	21 (33.9%)	
female	20 (71.4%)	8 (28.6%)	
Age (years)			0.003*
< 45	22 (52.4%)	20 (47.6%)	
≥ 45	39 (81.3%)	9 (18.7%)	
Education			0.321
Lower Bachelor's Degree	41 (64.1%)	23 (35.9%)	
Bachelor's Degree and higher	20 (76.9%)	6 (23.1%)	
Marital status			0.025*
Single	24 (55.8%)	19 (44.2%)	
Married	37 (78.7%)	10 (21.3%)	
Occupation			0.404
Without income/salary	14 (77.8%)	4 (22.2%)	
income/salary	47 (65.3%)	25 (34.7%)	

	Improved depression score (N=61)	Unimproved depression score (N=29)	P-value
Cause of injury			0.850
Fall	29 (64.4%)	16 (35.6%)	
Traffic accident	30 (71.4%)	12 (28.6%)	
Violence	1 (50.0%)	1 (50.0%)	
Other	1 (100.0%)	0 (0.0%)	
Level of impairment			0.099
Paraplegia	17 (54.8%)	14 (45.2%)	
Tetraplegia	25 (80.6%)	6 (19.4%)	
Normal	19 (67.9%)	9 (32.1%)	
Severity of injury			0.108
Complete	10 (50.0%)	10 (50.0%)	
Incomplete	32 (76.2%)	10 (23.8%)	
Normal	19 (67.9%)	9 (32.1%)	
Length of stay (days)			1.000
< 30	23 (67.6%)	11 (32.4%)	
≥ 30	38 (67.9%)	18 (32.1%)	

P-value were for the Chi-square test and Fisher's exact test

A P-value<0.05 indicates statistical significance

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อุบัติการณ์ของภาวะวิตกกังวลและซึมเศร้าในผู้ป่วยบาดเจ็บกระดูกสันหลัง ณ ศูนย์ผู้บาดเจ็บกระดูกสันหลัง โรงพยาบาลศิริราช

ศรินทร์ล ขวศิริ, พบ, นภชนก สุขประเสริฐ, ศศ.ม, ชลเวช ขวศิริ, พบ

ผลการศึกษาผู้ป่วยบาดเจ็บกระดูกสันหลังจำนวน 90 คน อายุเฉลี่ย 44.4 ปี (ส่วนเบี่ยงเบนมาตรฐาน 16.7 ปี, ระหว่าง 18-76 ปี) ร้อยละ 68.9 เป็นเพศชาย จากการใช้แบบประเมิน Thai HADS พบว่ามีอุบัติการณ์ของภาวะวิตกกังวลและภาวะซึมเศร้าเมื่อแรกรับ มีค่าเท่ากับ ร้อยละ 8.9 และ 7.8 ตามลำดับ และลดลงเป็นร้อยละ 4.4 และร้อยละ 5.6 ในวันจำหน่ายออกจากโรงพยาบาล คะแนนเฉลี่ยภาวะวิตกกังวลและภาวะซึมเศร้าลดลงเมื่อแรกรับจนถึงวันจำหน่ายออกจากโรงพยาบาล โดยคะแนนเฉลี่ยภาวะวิตกกังวลลดลงจาก 6.1 (SD=3.2) เป็น 3.2 (SD=2.9) และคะแนนเฉลี่ยภาวะซึมเศร้าลดลงจาก 5.1 (SD=3.4) เป็น 3.0 (SD=3.1) ไม่พบที่มีความสัมพันธ์ระหว่างผู้ป่วยที่มีคะแนนภาวะวิตกกังวลไม่ลดลงกับอายุ เพศ ระดับการศึกษา สถานภาพสมรส อาชีพ สาเหตุการบาดเจ็บ ระยะเวลาอนโรงพยาบาล ความรุนแรงของความพิการและการบาดเจ็บ แต่พบความสัมพันธ์ระหว่างผู้ป่วยที่มีคะแนนภาวะซึมเศร้าไม่ลดลงกับอายุ และสถานภาพสมรส ($P<0.05$) โดยกลุ่มอายุน้อยกว่า 45 ปีและกลุ่มโศกมีคะแนนความซึมเศร้าไม่ลดลงเมื่อเปรียบเทียบกับกลุ่มที่มีอายุ 45 ปีขึ้นไปรวมทั้งกลุ่มที่มีสถานภาพสมรส

A Case Report of Posterior Shoulder Dislocation with Greater Tuberosity Fracture

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Purpose: Posterior shoulder dislocation with fracture of greater tuberosity of the humerus is extremely rare. Therefore, the best prescribed treatment for it has not yet been established.

Methods: A 45-year-old male, the victim of motorcycle accident, presented with shoulder injury and deformity. Post injury radiographs demonstrated a posterior shoulder dislocation and hollow glenoid with bony fragments. Computed tomographic findings revealed a posterior shoulder dislocation with fracture of greater tuberosity of the humerus. A closed reduction procedure was successfully performed under general anesthesia.

Results: Anatomical reduction of shoulder joint and greater tuberosity fragment was achieved with good joint stability.

Conclusion: Closed reduction under general anesthesia is an effective treatment for posterior dislocation with fracture of greater tuberosity.

Keywords: Posterior shoulder dislocation, greater tuberosity, case report

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Introduction

Posterior dislocation of the shoulder is a rare injury and represents approximately 2-5% of all traumatic shoulder dislocations^(1,2). The overall incidence of posterior fracture-dislocations was 0.6 per 100,000 populations per year. The peak incidence was in middle-aged men, and most injuries were sustained during a seizure or a fall from a height. In most patients, there was a displaced primary fracture of the anatomic neck of the humerus, propagating from the area of an osteochondral fracture of the anterior aspect of the humeral head (a reverse Hill-Sachs lesion). Recommended treatment is open relocation of the humeral head with bone-grafting of humeral head defects, and internal fixation of the fracture. The combination of a greater tuberosity fracture with ipsilateral posterior glenohumeral dislocation is an even rarer event, for which there has been no reported treatment.

Almost of previous case reports of shoulder dislocation involved delayed diagnosed entities, which led to unsatisfactory patient outcome. A high index of suspicion and early diagnosis by adequate clinical radiological examination are required to prevent osteonecrosis of the humeral head, and to ensure satisfactory joint functional recovery.

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Case report

A 45-year-old male was referred to Khon Kaen Hospital after a road traffic accident. The patient was struck by a car while riding a motorcycle. He complained of pain and deformity over the right shoulder. Physical examination revealed an internally rotated and slightly adducted deformity of the injured limb, with limited motion in any direction. The posterior area of the shoulder was swollen and tender. There was no distal neurovascular deficit or associated injury. Plain radiographs revealed a posterior shoulder fracture dislocation with large bony fragments around the humeral head, which was not clearly identified (Fig.1-A, 1-B).

A U slab was then applied, and the patient was taken to the operating room within 48 hours. Under general anesthesia, closed reduction was successfully performed. The patient was positioned in supine, and the injured arm was then placed in traction, with the elbow pointing caudally. Then, through maintained traction and internal rotation reduction force, the medial side of the upper arm was pushed laterally using the leverage technique⁽³⁾, causing the humeral head to detach from the glenoid rim. The shoulder was then rotated externally, and joint reduction was achieved. After reduction, the shoulder's range of motion was full, with no clinical re-dislocation or instability present. Intraoperative fluoroscopic findings showed anatomic reduction of the shoulder joint and anatomically reduced greater tuberosity (Fig.3-A, 3-B). The shoulder was then immobilized with a sling 2 weeks then start pendulum exercise and progressive range of motion exercise.

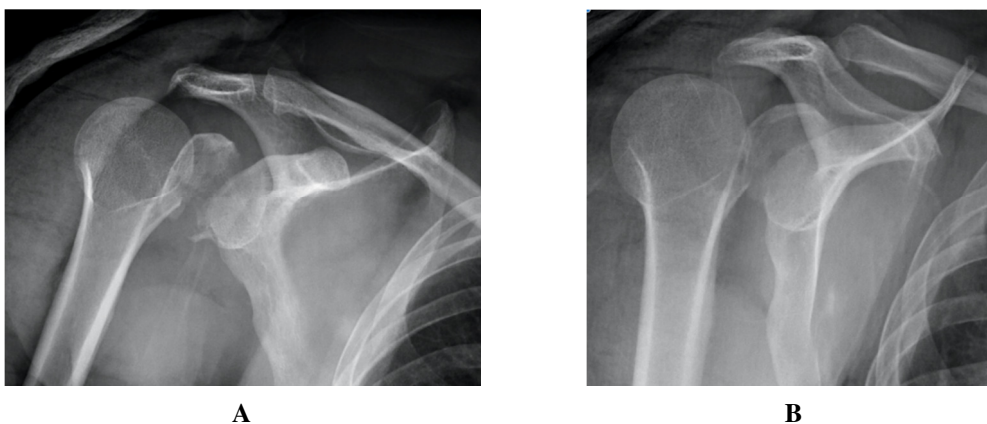


Fig.1-A film shoulder AP view, Fig.1-B film shoulder lateral scapular (Y view)

Preoperative radiographs show a posterior shoulder dislocation with large bony fragments, in which internal rotation deformity was also demonstrated.

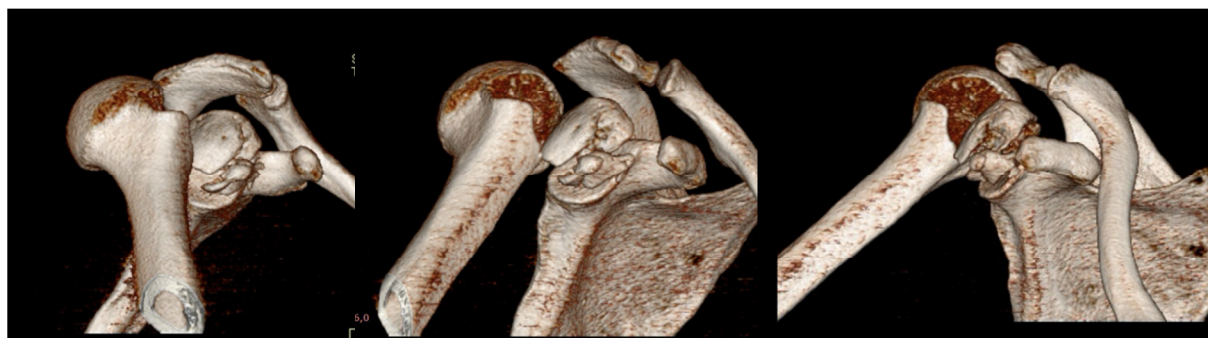


Fig.2 Computed tomographic 3D reconstruction findings demonstrate the more clearly identifiable posterior shoulder dislocation and greater tuberosity fracture.

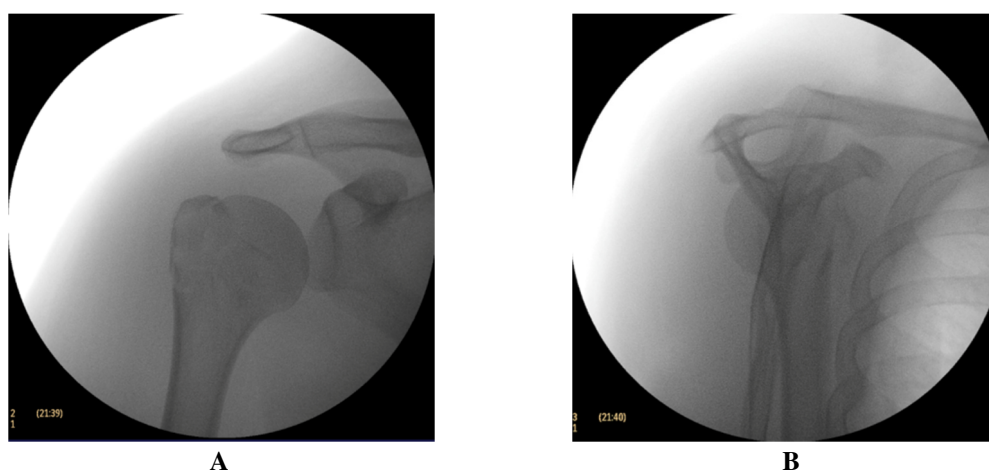


Fig.3-A film shoulder AP view, Fig.3-B film shoulder lateral scapular (Y view)

Intraoperative fluoroscopic findings show an anatomic reduction of the shoulder joint and greater tuberosity fragments.

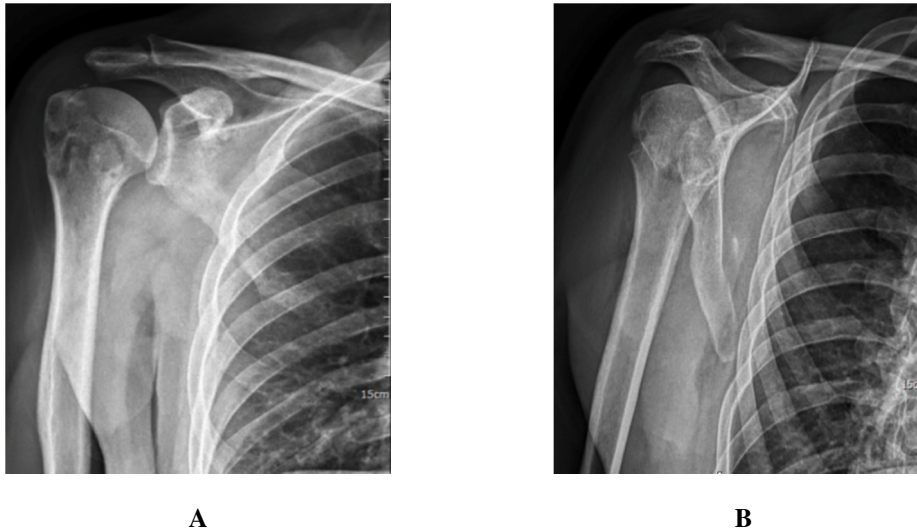


Fig.4-A film shoulder AP view, Fig.4-B film shoulder lateral scapular (Y view)

After Eight week post-operative radiographic findings demonstrated the maintainable alignment and some union (Fig.4-A,4-B). Painless shoulder movement with satisfied range of motion were achieved.

Discussion

Posterior shoulder dislocation is a rare injury. The three most common causes of posterior shoulder dislocation include a fall on the outstretched arm, a direct blow to the anterior aspect of the shoulder during an epileptic seizure, and electrocution or ECT (electroconvulsive therapy)⁽⁴⁻⁹⁾. Posterior dislocation of the shoulder is four times more common in males, with up to 65% of patients having associated injuries; which include fractures of the humeral neck (18.5%), lesser (14.3%) and greater (7.8%) tuberosity, reverse Hill-Sachs lesion (29%), and rotator cuff tear (2%)⁽⁴⁾. Closed reduction under general anesthesia provides anatomical reduction.

Inadequate radiographs and poor physical examination are the main factors of misdiagnosis. The classic physical findings of posterior dislocation include decreased anterior prominence of the humeral head, palpable posterior prominence of the humeral head, palpable prominence of the coracoid, marked limit of abduction, and complete absence of external rotation with a fixed internal rotation deformity⁽¹⁰⁾. Radiographs in AP, scapular Y, and axillary views are necessary; and the Velpeau axillary view is also useful⁽¹¹⁾. Several signs indicating posterior dislocation of the shoulder within the AP view have been described, including the positive rim sign and absence of the half-moon overlap⁽¹²⁾, the light-bulb sign, and the trough line⁽¹³⁾. If any suspicion arises, computed tomography (CT) scan can discover a posterior

shoulder dislocation, as well as define the extent of the displacement and the osseous abnormalities.

Previous studies have shown that the conventional closed reduction technique was successful in 42% of cases in a series of 12 fresh posterior dislocations. The main factors leading to unsuccessful closed reduction were tight locking of the glenohumeral joint due to a large impression fracture, delayed diagnosis of the dislocation, and anatomical neck fracture^(14,15). Soft-tissue lesions of the infraspinatus⁽¹⁶⁾ and/or bicep tendon interposition are some additional factors preventing successful closed reduction. In this case, closed reduction could be successfully performed because of the absence of reverse Hill-Sachs lesion which able to be an obstacle. Furthermore, this case was not a complex posterior shoulder fracture-dislocation by definition from Robinson M et al.⁽¹⁷⁾

Posterior shoulder dislocations are a common unrecognized injury. Hawkins et al., 1989; explained the delay in diagnosis by an average of one year in 75% of the cases studied⁽¹⁸⁾. Causes of delay in diagnosis included failure of the evaluating physician to include the condition in the differential diagnosis, suboptimal radiographic evaluation and interpretation, and coincidental injuries; such as fractures that can confound the patient's presentation. A delay in diagnosis and treatment of posterior shoulder dislocation or fracture-dislocation has increased risks of non-union, subsequent humeral head collapse, avascular necrosis, post-traumatic arthritis, and muscle wasting.

Conclusion

Posterior shoulder dislocation associated with fracture of the greater tuberosity is a rare injury. Closed reduction under general anesthesia can be the one of choice of treatment.

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รายงานผู้ป่วย ภาวะหัวไหล่หลุดหลังร่วมกับกระดูก *greater tuberosity* หักในข้างเดียวกัน

ศุภมงคล มัชฌิ, พบ, วันจักร พงษ์สมัครไทย, พบ

ภาวะหัวไหล่หลุดหลังพบได้ไม่บ่อย โดยเฉพาะไหล่หลุดหลังที่พบร่วมกับกระดูก *greater tuberosity* หักนั้น แทบจะไม่พบ รายงานผู้ป่วยส่วนใหญ่ภาวะไหล่หลุดหลังมักได้รับการวินิจฉัยล่าช้าหรือวินิจฉัยพลาด ทำให้ผลการรักษาไม่ดี ดังนั้นจำเป็นที่จะต้องซักประวัติ ตรวจร่างกาย และอ่านภาพรังสี ให้ถูกต้องเพื่อวินิจฉัยภาวะนี้

ผู้ป่วยชายอายุ 45 ปี ได้รับอุบัติเหตุถูกรถยนต์ชน ปวดไหล่ขวา ตรวจร่างกายพบว่ามีไหล่ขวาผิดรูป แขนขาชิด ลำตัวและหมอนเข่าด้านใน ด้านหลังของไหล่นวมขึ้น ไม่สามารถเหยียดได้ ตรวจระบบอื่นปกติ ภาพรังสี แสดงว่ามี *proximal humerus fracture* และมีกระดูกชิ้นใหญ่ขวางแนวข้อไหล่ และสงสัยไหล่หลุดหลัง จึงได้ส่งเอกซเรย์คอมพิวเตอร์เพื่อยืนยัน พบว่ามีไหล่หลุดหลังและมี *greater tuberosity* หัก

การรักษาในเบื้องต้นได้ใส่ *arm sling* และนำผู้ป่วยเข้าห้องผ่าตัดได้รับการดมยาสลบและได้ดึงไหล่ให้เข้าที่ หลังดึงพบว่าข้อไหล่มั่นคงดี และภาพรังสีแสดงกระดูก *greater tuberosity* เข้าที่ และข้อไหล่เข้าที่ดี

ภาวะหัวไหล่หลุดหลังที่พบร่วมกับกระดูก *greater tuberosity* หัก สามารถรักษาโดยการดึงไหล่ภายใต้การดมยาสลบ

Anterior Extrusion of Bone Graft after Posterior Lumbar Interbody Fusion with development Deep Vein Thrombosis: Case Report and Literature review

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Background: Anterior bone graft extrusion is a very rare complication. Most patients with this type of extrusion are asymptomatic. Only few studies reported with the development of deep vein thrombosis (DVT) due to anterior bone graft extrusion and the detailed about the management.

Propose: The propose of this study is to report a patient with anterior bone graft extrusion with development of DVT without revision spinal surgery.

Materials and Methods: The authors demonstrated case by describing the patient's history, physical examination, imaging studies and treatment. We also reviewed and discussed related literatures.

Results: The patients with foraminal stenosis and disc extrusion of L4-S1 was performed posterior decompression and posterior lumbar interbody fusion of L4-S1. Postoperatively, the patient developed left thigh pain and swelling. The diagnosis of proximal DVT at left common iliac vein was confirmed by Doppler ultrasound and 3D CT angiography. The patient was treated with intervention; stent insertion at left common iliac vein, balloon dilatation, Inferior vena cava(IVC) filter, thrombectomy, injection of low molecular weight heparin. The patients showed an improvement in the clinical of radicular pain and thigh swelling.

Conclusion: Proximal DVT due to anterior bone graft extrusion is a very rare complication. The most important clinical symptoms are thigh swelling and pain. We must recognize patient's early symptoms and give an early diagnosis due to proximal DVT could be develop pulmonary thromboembolism and lead to death. Furthermore, the revision spinal surgery is more complex and associated with severe complications. This study described the management of DVT with nonsurgical approach, such as thrombectomy, common iliac vein stent, IVC filter insertion with an application of anticoagulants without going through revision spinal surgery.

Keywords: Deep vein thrombosis, posterior lumbar interbody fusion, complication, anterior bone graft extrusion

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Introduction

Lumbar intervertebral graft extrusion is a complication that can occur during or after lumbar disc surgery. Anterior graft extrusion is less frequent but can be found after the surgery. The previous studies⁽¹⁻⁵⁾ reported the incidence of anterior graft extrusion is 0.6-0.8% and most patients are asymptomatic. A few case reports⁽¹⁻⁵⁾ described complication and management.

The main propose of this study was to report a case with anterior bone graft extrusion with development of proximal deep vein thrombosis (DVT) similar to previous reports⁽¹⁻⁵⁾. But these

patients had treatment with intervention; stent insertion at left common iliac vein, Inferior vena cava (IVC) filter insertion, thrombectomy, and anticoagulation without revision spinal surgery.

Case report

A 72-year-old male came with right buttock pain radiating down to the right ankle and the right foot was dropped for 2 weeks. The patient had a history of hypertension and old CVA but he was denied history of previous venous thromboembolism and smoking. Physical examination showed decreased sensation of his right foot. The motor power of the right ankle dorsiflexion was grade III and right big toe dorsiflexion was grade IV, while others were grade V. His patellar reflex are 2+ on both sides. His body mass index (BMI) was 25.9 kg/m². Magnetic resonance imaging (MRI) studies demonstrated disc extrusion at L4-5 and L5-S1, with right

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extraforaminal extension and severe right foraminal stenosis at L5-S1.

After Intubation, the patient was turned to prone position on the operative table. We performed a standard midline posterior approach, identified the bony landmark and level of pathology with intraoperative fluoroscope, insertion of pedicle screw at L4-S1 (Iliad®, Medyssey), confirmed the level and position of screw with fluoroscope, then performed posterior decompressive laminectomy L4-S1 with foraminotomy at right site of level L5-S1. The dura mater is exposed and delicately pushed back with a blunt retractor toward the midline but during traction the dura, an epidural vein was torn, we was controlled bleeding by using bipolar cauterization and packing gelatin-based sponges. After controlled bleeding, we performed open discectomy at L4-5 and L5-S1, removed disc material and irrigation disc space then used curettage to prepared vertebral endplate for fusion, insertion chip autogenous bone graft (1-2 ml per each level) between disc space and insertion titanium PLIF cage size width 11 mm, length 28 mm, 12 degrees lordotic angle (filled with autogenous bone graft and hydroxyapatite) at L4-5 and L5-S1 bilateral by manually. (Figure 1). Intraoperative blood loss was 2000mL. The patient reported an improvement in radicular symptoms after the surgery. On the postoperative day 1-16, he had no other complication, treated by routine postoperative care, rehabilitation program, and discharge to his home on day 13.

On the postoperative day 17, he complained about pain and swelling in the left thigh. His dorsalis pedis artery was palpable on both sides. A blood test for D-dimer was 3.79 µg/mL. The patient was immediately admission and received doppler ultrasound, 3-D computed tomography(CT) angiography and chest CT scanning. The result was acute DVT in left common iliac vein, external iliac vein, common femoral vein, superficial femoral vein and popliteal vein with thrombus in greater saphenous vein. No thrombosis was found in posterior tibial vein and there was no evidence of arterial stenosis or flow disturbance. Anterior bone graft extrusion was found at L4-5 level (Figure 2). Chest CT scanning revealed no evidence of pulmonary embolism. A vascular surgeon was consulted, and we decided to perform a stent insertion at left common iliac vein, balloon dilatation and IVC filter, thrombectomy at left common iliac, external iliac, common femoral and popliteal veins (Figure 3), low molecular weight heparin Enoxaparin 1mg/kg subcutaneously every 12 hours was started immediately and convert to oral warfarin for 3 months. His leg swelling was gradually disappeared in the next 2 weeks.

The 3-D CT angiography was obtained 6 weeks postoperatively and it demonstrated IVC filter insertion stated. The left common iliac, external iliac, common femoral, popliteal veins were decreased in size, but small trapped thrombus was still remained compared to the previous CT. The patient showed markedly improved conditions of left thigh swelling and edema. At the last follow-up (14 months postoperatively), the patient had no pain or swelling in his leg. The 3-D CT angiography showed the remaining anterior extrusion of bone graft, despite radiographic union. (Figure 4)

Discussion and Literature review

The PLIF procedure was pioneered in the 1940s by Ralph B. Cloward. The procedure was advocated because it allows posterior decompression of the neural elements while providing stabilization of the affected spinal motion segment. Based on the previous studies⁽⁶⁻⁷⁾, the PLIF procedure can be technically difficult. The complications associated with PLIF included dural laceration, wound infection, postoperative radiculopathy, graft migration, pseudarthrosis, implant subsidence, epidural hemorrhage, vascular complication and bone graft donor-site morbidity. The intervertebral graft extrusion can occur frequently in the posterior direction. Anterior graft extrusion is found less frequently, but it may still occur after the procedure. Previous studies⁽¹⁻⁵⁾ reported an incidence of anterior graft extrusion between 0.6-0.8% and most patients show no clinical symptom. Some case reports⁽²⁻⁵⁾ described complication and management of anterior graft extrusion. The potential risk factors of this type of graft extrusion include, but not limit to, the perforation of the annulus fibrosus and anterior longitudinal ligament, disc space violation, inadequate fixation, improper endplate preparation or graft placement. Graft migration can also occur in patients with osteomyelitis, discitis, or pseudarthrosis^(3,4).

The incidence of DVT after spinal surgery is highly variable ranging from 0.3-31% from the previous studies⁽⁸⁻¹³⁾. Yang and colleagues⁸ reported 15.9% incidence in patients undergoing lumbar interbody fusion. The time to the onset of DVT after spinal surgery is variable from day 2 to 30 after surgery. It is the most common complication and a potentially lethal disease. The risks of DVT are multifactorial, such as advanced age, previous history of DVT, obesity, smoking, impaired mobility, high blood pressure, and high levels of serum D-dimer. In 2015 Wang TY et al.⁽¹¹⁾ reported an incidence of DVT within 30 days after lumbar surgery was 1.1% (15 from 1346 patients). Multivariate logistic regression determined that previous DVT, postoperative

urinary tract infection and creatinine level > 2.0 mg/dL were identified as risk factor for DVT.

In this study, the development of DVT may be caused by advanced age, history of hypertension, and postoperative impaired mobility, and the close proximity of the bone graft extrusion at L4-5 level to left common iliac vein. On the postoperative day 17, the patient complained about pain and swelling in the left thigh. It was not common clinical symptoms of DVT of lower extremities which presented by leg or calf edema and pain. The Doppler ultrasound and 3-D CT angiography was acute DVT in left common iliac, external iliac, common femoral, superficial femoral, and popliteal veins with thrombus in greater saphenous vein, it was corresponding with previously called "Proximal DVT". The proximal DVT is caused by mechanical obstruction of the left common iliac vein by the bone graft extrusion resulting in stasis rather than a primary hypercoagulable state^(12,19). In 2012, Nyamekye I and Merker L were reported a management strategies for proximal DVT. Anticoagulation alone has no significant thrombolytic activity and has not impact on prevention. They were recommended early thrombus removal for reduced post-thrombotic syndrome, combined pharmacomechanical thrombolysis to enhance early thrombus removal.

In 2007, Yoshimoto H. et al.⁽²⁾ reported a case of DVT after posterior lumbar interbody fusion(PLIF). The thrombosis was caused by migrated bone graft fragment from the interbody fusion site at L5/S1, which occluded the left common iliac vein at the bifurcation. The patient became symptomatic on the postoperative day 2 and underwent a revision surgery and an excision of the bone graft by a retroperitoneal approach. Puwar et al. was reported a case L3/4 spondylodiscitis treated with PLIF procedure. Intraoperative was found a cage migration in to Lt. pulmonary artery but the patient was asymptomatic. The author was compared this case report with previous studies in table 1.

The revision surgeries are more complicated and associated with a higher risk of complications. Nguyen HV. et al.⁽¹⁴⁾ reported in a series of 14 patients, 8 of whom had pseudarthrosis or infection with cage migration. Of all patients, 57% of patients had vascular complications, and 1 patient died while undergoing a revision surgery using either transperitoneal or retroperitoneal approach. Fantini GA. et al.⁽¹⁵⁾ reported a retrospective case series of 345 operations in 338 patients. The incidence of major vascular injury during anterior lumbar surgery is 2.9% (10 of 345 operations). Risk factors of such injury are previous osteomyelitis, discogenic infection, spondylolisthesis grade II, large anterior osteophyte, transitional lumbosacral vertebra, and anterior migration of

interbody device. Allen and colleagues⁽¹⁶⁾ also reported an incidence of vascular injury during anterior exposure of the spine is at 11% (54 of 480 patients) and the most common site of the injury is at L4-5 level (83%). Gumbs AA. et al.⁽¹⁷⁾ reported in a retrospective case series of 218 patients whom had open anterior approach during spine procedure and 9 patients had revision procedures. The 5 of 9 patients of revision procedure also had complication. Early complications occurred in 4 patients (44%), and including dural tear, median nerve dyesthesia, left common femoral nerve palsy, prolonged postoperative ileus and retrograde ejaculation. Late complications occurred in one patient and consisting of a DVT and urinary tract infection. Ralph J. Mobbs et al.⁽¹⁸⁾ reported in a study of 227 patients who had approach-related complication of anterior lumbar interbody fusion. An intraoperative vascular injury requiring primary repair with suturing occurred in 15 patients (6.6%), 3 patients (1.3%) had incisional hernia requiring revision surgery, 7 patients (3.1%) had prolonged ileus (>7 days) managed conservatively, 4 patients had retrograde ejaculation, 15 patients (6.6%) had sympathetic, 5 patients (2.2%) had superficial wound infection treated with oral antibiotics, but there were no deep wound infections requiring reoperation or intravenous therapy. Dominique A. Rothenfluh et al.⁽⁹⁾ reported access-related complications in anterior lumbar surgery in 31 patients over 60 years-old. The overall complication was 29% which included 4 vascular injuries and 1 pulmonary embolism. The vascular complication rate was 13 % (4 in 31 patients) with 2 cases of arterial and 2 cases of venous injuries requiring repair.

Because of the concerns over risks and complications from revision surgery reported in previous studies. We decided to treatment our patient without revision surgery. We reported a patient with anterior bone graft extrusion and the development of proximal DVT. The patient had treatment with intervention; stent insertion at left common iliac vein, IVC filter insertion, thrombectomy and anticoagulation without any risk of the revision spinal surgery.

Conclusion

Anterior bone graft extrusion could be result in proximal DVT by the compression of the left common iliac vein. Early detection, such as swelling and pain of the thigh region is important for preventing pulmonary thromboembolism, which occurs frequently in proximal DVT.

In patient with proximal DVT, Nonsurgical approach such as stent insertion, IVC filter insertion and thrombectomy with an application of anticoagulants, may be considered in such cases without going through revision spinal surgery



Fig.1 Anteroposterior (left) and lateral (right) radiographs taken immediately after PLIF surgery reveals proper placement of pedicle screws and intervertebral cage, but shows some bone graft anterior to L4-5 disc space (white arrow).

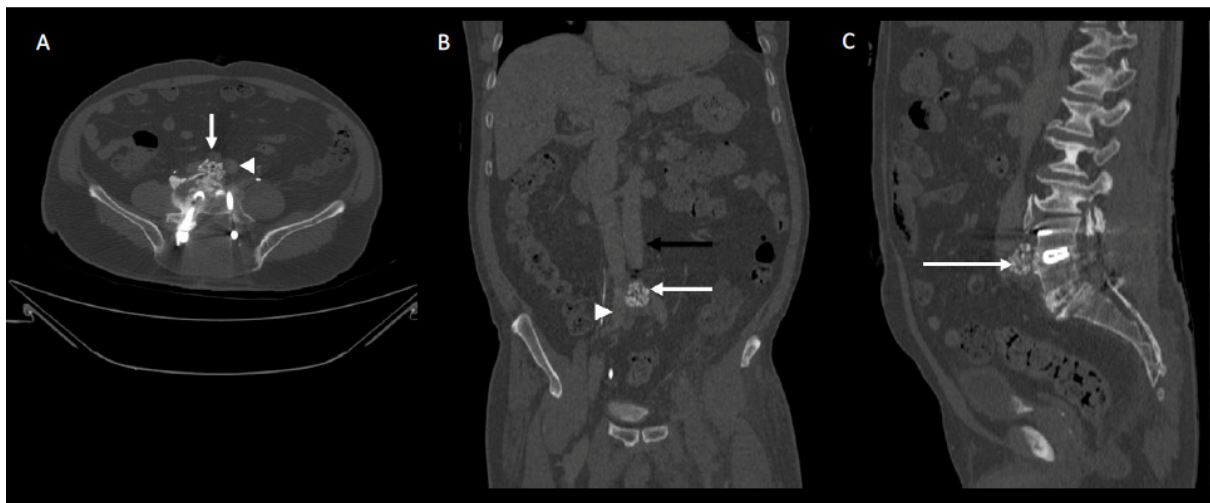


Fig.2 The 3-D computed tomography (CT) angiography at L4-5 on postoperative day 17

- A. Axial view reveals anterior extrusion of bone graft at L4-5 disc space level with compression left common iliac vein (white arrow), but intact left common iliac artery (white arrow head).
- B. Coronal view reveals anterior extrusion of bone graft with compression left common iliac vein (white arrow), but intact aorta (black arrow), and right common iliac vein (white arrow head)
- C. Sagittal view reveals anterior extrusion of bone graft at L4-5 disc space level. (white arrow)

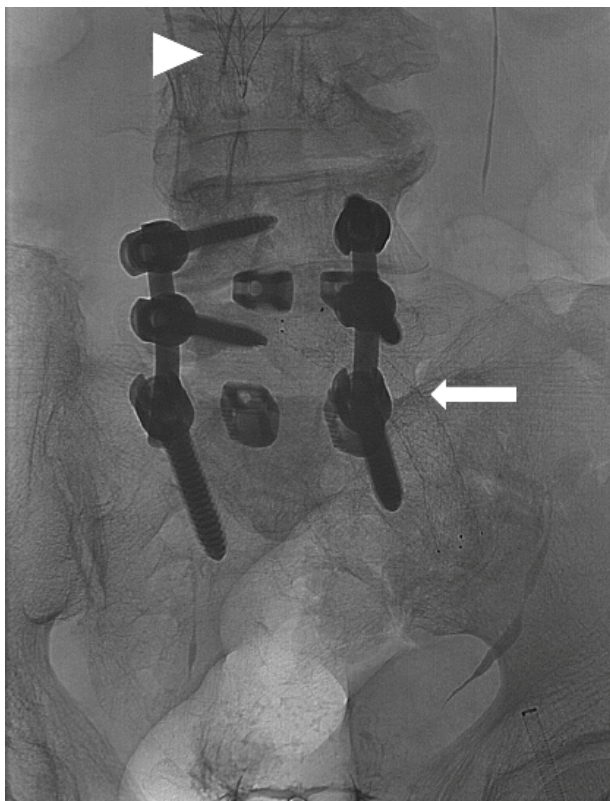


Fig.3 Insertion stent at left common iliac vein (white arrow) and IVC filter (white arrow head).

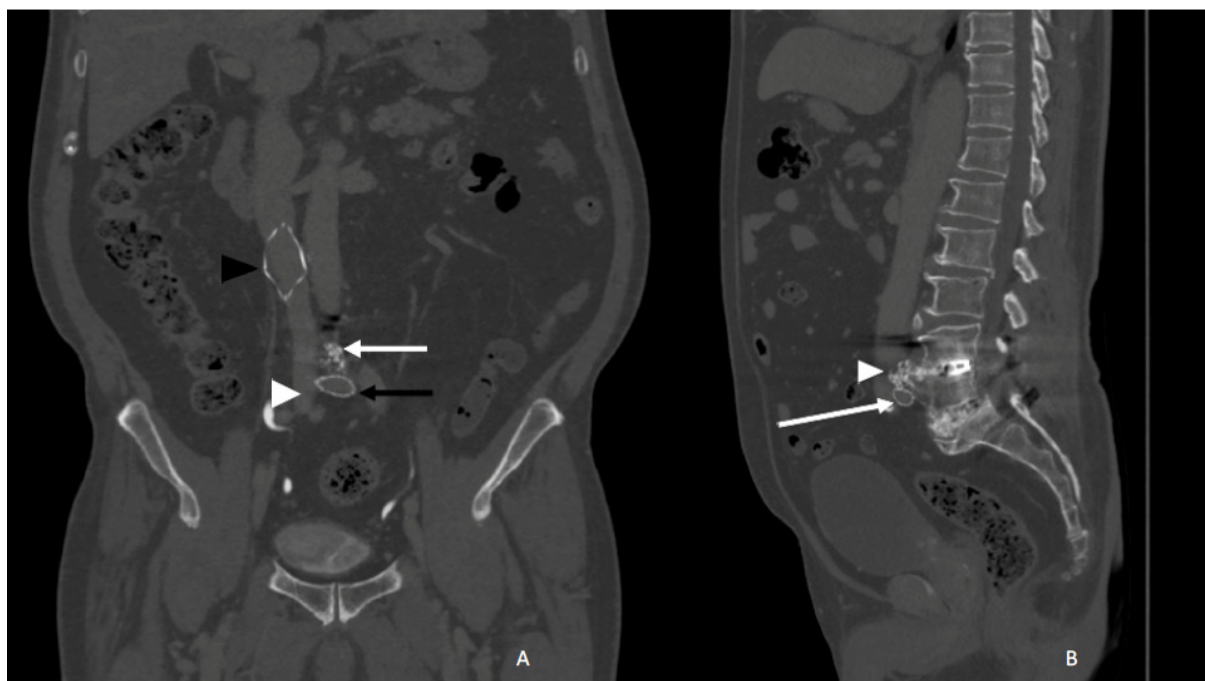


Fig.4 The 3-D computed tomography (CT) angiography obtained at 14 months postoperative

- A. Coronal view reveal bone graft extrusion (white arrow), stent at left common iliac vein (black arrow), IVC filter (black arrow head) and intact right common iliac vein (white arrow head).
- B. Sagittal view reveals the remaining of anterior extrusion of bone graft at L4-5 disc space (white arrow head) with stent at left commoniliac vein (white arrow), and radiographic union.

Author	Year	Preoperative Diagnosis	Index surgery	Level of extrusion	Compression site	Onset of complication	Management
Bingo H	2002	NA	Lumbar Disc surgery	L4-L5 (n=12) L5-S1 (n=1)	Lt. common iliac artery (n=6) Pseudoaneurysm (n=4) AVF (n=1) Aortic bifurcation (n=1) IVC (n=1)	Immediate to 8 months	Dacron graft (n=4) Primary suture (n=4) Saphenous vein Graft (n=1) Resection&end to end anastomosis (n=4)
Yoshimoto H	2007	Isthmic spondylolisthesis L5-S1	PLIF	L5-S1	Lt. common iliac vein	Day 2	Excision
Pawar UM	2010	Spondylodiscitis L3-L4	TLIF	L3-L4	Lt. pulmonary artery	Intraoperative	Observe
This study	2016	Spinal stenosis L4-S1	PLIF	L4-L5	Lt common iliac vein	Day 17	Thrombectomy, stent, IVC filter, Anticoagulant drug

NA, not applicable; PLIF, posterior lumbar interbody fusion; TLIF, transforaminal lumbar interbody fusion
Table 1 Compared the details of this case with previous case reports.

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กรณีศึกษาผู้ป่วยหลอดเลือดดำที่ขาอุดตันเนื่องจากการกดทับของกระดูกภายหลังการผ่าตัด *Posterior lumbar interbody fusion* โดยวิธีไม่ต้องผ่าตัดซ้ำ

ธนิตา ปัญญาอมรวัฒน์, พบ, จงฮี ลี, คยองซุง คัง, ชึงจุน ชิน, คีทัก คิม, วอนจู ชิน

วัตถุประสงค์: ศึกษาผู้ป่วยหลอดเลือดดำที่ขาอุดตันเนื่องจากการกดทับของกระดูกภายหลังการผ่าตัด *Posterior lumbar interbody fusion* โดยวิธีไม่ต้องผ่าตัดซ้ำ

ผลการศึกษา: ผู้ป่วยชาย อายุ 72 ปี มีอาการของโรคโพรงกระดูกสันหลังคับแคบและหมอนรองกระดูกระดับเอวเคลื่อน ทำการผ่าตัด *Posterior decompression and posterior lumbar interbody fusion of L4-S1* หลังการผ่าตัดวันที่ 17 มีอาการของภาวะหลอดเลือดดำที่ขาซ้ายอุดตัน ตรวจ *Doppler ultrasound* และ *3D CT angiography* พบการกดทับของ *left common iliac vein* เนื่องจากกระดูกที่มาจากการทำ *posterior lumbar interbody fusion* ได้รับการรักษาโดยการใส่ *stent* ที่ *left common iliac vein*, ทำ *balloon dilatation*, ใส่ *Inferior vena cava (IVC) filter*, *thrombectomy* และให้ยา *intravenous low molecular weight heparin* ภายหลังการรักษาอาการทุเลาลง โดยไม่ต้องใช้วิธีผ่าตัดซ้ำที่กระดูกสันหลัง

สรุป: ผู้ป่วยที่มีภาวะหลอดเลือดดำที่ขาอุดตัน เนื่องจากการกดทับของกระดูกภายหลังการผ่าตัด *Posterior lumbar interbody fusion* สามารถรักษาโดยการใส่ *stent*, *IVC filter*, *thrombectomy* และให้ยาละลายลิ่มเลือด โดยไม่ต้องรับการผ่าตัดซ้ำที่กระดูกสันหลังซึ่งเป็นการผ่าตัดที่มีความเสี่ยงสูง

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The Thai Journal of Orthopaedic Surgery is an official journal of **The Royal College of Orthopaedic Surgeons of Thailand**. It will accept original papers on clinical and experimental research that are pertinent in Orthopaedics. Original articles, short communication, case reports, review articles, letters to the Editor and miscellany are welcome.

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คำแนะนำสำหรับผู้ส่งบทความเพื่อลงตีพิมพ์

จุดมุ่งหมายและขอบเขต

วารสาร The Thai Journal of Orthopaedic Surgery เป็นวารสารทางวิชาการของราชวิทยาลัยแพทย์ออร์โธปิดิกส์แห่งประเทศไทยที่พิมพ์เผยแพร่อย่างสม่ำเสมอทุก 3 เดือน (4 ฉบับ/ปี) ทั้งแบบเป็นเอกสารรูปเล่ม และแบบออนไลน์ โดยเป็นวารสารที่ได้รับการประเมินบทความโดยผู้ทรงคุณวุฒิ (peer-reviewed journal) เพื่อเปิดโอกาสให้นักวิชาการที่สนใจเสนอบทความที่เกี่ยวข้องกับการรักษาผู้ป่วยและผลงานวิจัยทางศัลยศาสตร์ออร์โธปิดิกส์

เพื่อรักษามาตรฐานของวารสาร บทความที่จะลงตีพิมพ์ในวารสารจำเป็นต้องเขียนเป็นภาษาอังกฤษ ซึ่งประกอบด้วย Original Articles, Case Report, Review Articles, Letter to the Editor และ Miscellany

บทความประเภท Original articles เป็นรายงานผลการวิจัยทางด้านศัลยศาสตร์ออร์โธปิดิกส์ และสาขาอื่นที่เกี่ยวข้อง

บทความ Review articles เป็นบทความที่รวบรวมเอาผลงานในเรื่องใดเรื่องหนึ่งโดยเฉพาะ ซึ่งเคยลงตีพิมพ์มาแล้ว นำมาวิเคราะห์ วิจัย เพื่อให้เกิดความกระจ่างในเรื่องนั้นยิ่งขึ้น

รายงานผู้ป่วย (Case report) เป็นรายงานผู้ป่วย วิเคราะห์อาการทางคลินิกและผลตรวจทางห้องปฏิบัติการที่น่าสนใจ เรื่องที่ส่งมาต้องไม่เคยพิมพ์เผยแพร่มาก่อน กองบรรณาธิการขอสงวนสิทธิ์ในการตรวจทาน แก้ไขต้นฉบับ และพิจารณาตีพิมพ์ข้อคิดเห็นในบทความเป็นความเห็นและเป็นความรับผิดชอบของเจ้าของบทความโดยตรง

การส่งบทความ

ทางราชวิทยาลัยฯ ขอแจ้งให้ทราบว่า เพื่อความสะดวกรวดเร็วและมีประสิทธิภาพในการส่งบทความ ราชวิทยาลัยฯ ผู้เขียนสามารถเสนอบทความเพื่อพิจารณาได้ทางจดหมายอิเล็กทรอนิกส์ secretariat@rcost.or.th

ประเภทของบทความ

- นิพนธ์ต้นฉบับ (original articles) ให้มีความยาวไม่เกิน 5,000 คำ, เอกสารอ้างอิงไม่เกิน 40 ข้อ, รูปภาพและตารางรวมกันไม่เกิน 6 รูป
- บทความปริทรรศน์ (review articles) ให้มีความยาวไม่เกิน 10,000 คำ, เอกสารอ้างอิงไม่เกิน 100 ข้อ, รูปภาพและตารางรวมกันไม่เกิน 10 รูป
- รายงานผู้ป่วย (case report) ให้มีความยาวได้ 1,500 คำ, รูปภาพและตาราง 1-2 รูป/ตาราง, เอกสารอ้างอิงไม่เกิน 20 ข้อ
- จดหมายให้มีความยาวได้ 500 คำ
- บทบรรณาธิการ

การเตรียมต้นฉบับ

- **เกณฑ์การเขียนบทความ**
 1. อธิบายเนื้อหาของบทความหรือวิเคราะห์ข้อมูลที่นำมาให้ชัดเจน
 2. หากต้นฉบับมีข้อผิดพลาดของรูปแบบหรือมีความไม่สมบูรณ์ขององค์ประกอบในบทความ บทความนั้นจะถูกส่งกลับไปยังผู้เขียนเพื่อทำการแก้ไขต่อไป

3. แก้ไขปรับปรุงเนื้อหาของต้นฉบับตามคำแนะนำของผู้ประเมินบทความ
- หากมีการเขียนบทความโดยกลุ่ม กรรมการระบุชื่อผู้เขียนทุกคน และระบุชื่อผู้วิจัยหลักให้ชัดเจน
- ควรแสดงความขอบคุณแก่บุคคลที่ไม่ได้มีส่วนร่วมในการเขียนบทความ แต่มีส่วนช่วยเหลือโดยตรงในการวิจัย เช่น ผู้ช่วยทางเทคนิค, ที่ปรึกษาด้านการเขียนบทความ, ผู้สนับสนุนทุนและวัสดุในการทำงานวิจัย เป็นต้น ไว้ในกิตติกรรมประกาศ (acknowledgements)
- บทความที่ส่งมาจะต้องเป็นเรื่องที่ไม่เคยตีพิมพ์ที่ไหนมาก่อน และผู้เขียนจะต้องไม่ส่งบทความเพื่อไปตีพิมพ์ในวารสารฉบับอื่นในเวลาเดียวกัน

หลักเกณฑ์สำหรับผู้เขียนบทความ

- ผู้เขียนบทความต้องไม่มีเจตนาส่งข้อมูลเท็จ
 - บทความที่ส่งมาต้องเป็นผลงานของตนเอง
 - ผู้เขียนบทความจะต้องไม่ส่งบทความที่เคยลงตีพิมพ์ในวารสารอื่น โดยไม่ระบุว่าท่านได้เสนอผลงานนั้นในวารสารใดบ้างอย่างถูกต้องและสมเหตุสมผล
 - ต้องระบุรายชื่อผู้เขียนทุกคนตามความเป็นจริง
 - ผู้เขียนบทความต้องส่งต้นฉบับที่ได้รับการรับรองที่แท้จริง
 - ผู้เขียนบทความต้องไม่ใช้วิธีการศึกษาที่มีผู้เผยแพร่มาก่อน โดยไม่ได้รับการอนุมัติจากเจ้าของลิขสิทธิ์
- **หน้าแรก (Title page)** เขียนเป็นภาษาไทยและภาษาอังกฤษ ประกอบด้วย
 - (1) ชื่อ สกุลของผู้เขียน
 - (2) ชื่อเรื่องอย่างย่อ ที่สื่อความหมายและชี้ให้เห็นสาระสำคัญของเนื้อหาในฉบับบทความ
 - (3) สถานที่ทำงาน
 - (4) เบอร์โทรศัพท์, เบอร์แฟกซ์ และ e-mail address ของผู้เขียน
 - **บทคัดย่อ (Abstract)** ต้องมีทั้งภาษาไทยและภาษาอังกฤษมีความยาวไม่เกิน 250 คำ โดยเรียงลำดับเนื้อหา ดังนี้
 - (1) วัตถุประสงค์ (Purpose)
 - (2) วิธีการศึกษา (Methods)
 - (3) ผลการศึกษา (Results)
 - (4) สรุป (Conclusions)
 - **คำสำคัญ (Keyword)** ระบุไว้ได้บทคัดย่อ มีความยาว 4 - 6 คำ
 - **ต้นฉบับ (Manuscript)** เป็นภาษาอังกฤษ
 - **เนื้อเรื่อง (Text Formatting)** ให้ลำดับความสำคัญของเนื้อหาดังนี้คือ บทนำ (introduction), วิธีการศึกษา (methods), ผลการศึกษา (results), วิเคราะห์ (discussion), บทขอบคุณ (acknowledgements), เอกสารอ้างอิง (references), ตารางและรูปภาพประกอบ (tables and figures) โดยต้นฉบับจะต้องใช้รูปแบบ ดังนี้
 - (1) ใช้ตัวพิมพ์มาตรฐาน เช่นภาษาอังกฤษ ใช้ตัวอักษร “Times Roman” ขนาด 10 point ภาษาไทยใช้ ตัวอักษร “Angsana New” ขนาด 12 point
 - (2) พิมพ์ข้อความสำคัญด้วยตัวเอน
 - (3) ตั้งค่าเลขหน้าโดยอัตโนมัติ

- (4) ไม่ใช่ “field functions”
 - (5) ใช้ปุ่ม “Tab” เมื่อขึ้นย่อหน้าต่อไป
 - (6) เลือกคำสั่งตาราง (Table) เมื่อต้องการพิมพ์ตาราง
 - (7) หากใช้โปรแกรม “Microsoft Word 2007” ให้ใช้โปรแกรม “Microsoft equation editor” หรือโปรแกรม “Math Type”
 - (8) ส่งต้นฉบับในรูปแบบของแฟ้มข้อมูล โดยบันทึกข้อมูลเป็นไฟล์ “.doc” และห้ามบันทึกเป็นไฟล์ “.docx”
- หัวข้อ (headings) ไม่ควรมีขนาดต่างๆมากกว่า 3 ระดับ
 - คำย่อ (abbreviations) จะต้องมีคำเต็มเมื่อปรากฏเป็นครั้งแรกในบทความ หลังจากนั้นสามารถใช้คำย่อเหล่านั้นได้ตามปกติ
 - เชิงอรรถ (footnotes) คือ การอ้างอิงข้อความที่ผู้เขียนนำมากล่าวแยกจากเนื้อหาอยู่ตอนล่างของหน้า โดยใส่หมายเลขกำกับไว้ท้ายข้อความที่คัดลอกหรือเก็บแนวคิดมา และจะไม่เขียนเชิงอรรถเอาไว้ที่หน้าแรกของบทความ ถ้าต้องการแสดงที่มาของตารางหรือภาพประกอบให้ใช้เครื่องหมายแทนตัวเลข โดยเขียนไว้ที่ส่วนล่าง ของหน้า หรือใช้เครื่องหมายดอกจัน (*) เพื่อแสดงความหมายของคำหรือข้อมูลทางสถิติ
 - กิตติกรรมประกาศ (acknowledgements) เป็นการแสดงความขอบคุณแก่ผู้ที่ช่วยเหลือในการทำวิจัย หรือผู้สนับสนุนทุนการวิจัย เป็นต้น โดยจะเขียนไว้ก่อนเอกสารอ้างอิงและควรเขียนชื่อสถาบันที่ให้การสนับสนุนทุนการวิจัย โดยใช้ชื่อเต็ม
 - ตาราง (tables)
 - (1) ให้เขียนหมายเลขตารางเป็นเลขอารบิก
 - (2) ให้เรียงตามลำดับที่ของตารางอย่างต่อเนื่องจาก 1, 2, 3,
 - (3) การอธิบายผลในตารางต้องไม่ซ้ำซ้อนกันและมีใจความกระชับรัดกุม และมีคำอธิบายกำกับไว้เหนือตาราง
 - (4) เขียนคำอธิบายเพิ่มเติมเกี่ยวกับแหล่งที่มาของเอกสารอ้างอิงไว้ที่ได้ตาราง
 - (5) เชิงอรรถ (footnotes) ของตารางจะเขียนไว้ใต้ตารางหรือใช้เครื่องหมายดอกจัน (*) เพื่อแสดงความหมายของคำหรือข้อมูลทางสถิติ
 - รูปภาพ (figures)
 - (1) ให้ใช้โปรแกรมกราฟฟิคคอมพิวเตอร์ในการวาดรูป
 - (2) รูปภาพที่เป็นลายเส้นควรใช้รูปแบบ EPS ในการวาดเส้นรูปภาพและรูปภาพที่เป็น โทนสีควรใช้รูปแบบ TIFF ในการไล่เฉดสี
 - (3) รูปภาพทุกรูปจะต้องมีหมายเลขและคำบรรยายภาพกำกับไว้ใต้ภาพ โดยใช้ชื่อรูปภาพเป็น “Fig” ตามด้วยลำดับที่ของรูปภาพ เช่น “Fig.1” เป็นต้น
 - เอกสารอ้างอิง (references) เรียงลำดับเลขการอ้างอิงตามเอกสารอ้างอิงท้ายบทความ และใช้ตาม Vancouver style การอ้างอิงถึงชื่อบุคคล ถ้ามีผู้เขียนมากกว่า 6 คน ให้ใส่ชื่อ 6 คนแรก แล้วตามด้วย et al. ส่วนการเขียนเอกสารอ้างอิงท้ายบทความ การย่อชื่อวารสารให้ใช้ตาม Index Medicus โดยศึกษาได้ในเว็บไซต์ <http://www.medscape.com/home/search/indexMedicus/IndexMedicus-A.html>
- กรุณาลงนามในแบบฟอร์มการส่งบทความเพื่อขอตีพิมพ์ เพื่อแสดงว่าผู้เขียนได้อ่านเกณฑ์การเขียนบทความทั้งหมด
- ตัวอย่างการเขียนเอกสารอ้างอิง (references) กรุณาดูในหัวข้อ “Instruction to authors ”