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SPINAL FUSION ON OSTEOPOROTIC SPINE WITH POLYMETHYLMETHACRYLATE AUGMENTED CONVENTIONAL PEDICLE SCREW

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ABSTRACT

Introduction: *With increased aging of society, instrumental surgery for an osteoporotic spine has been increasing. However, spinal fusion on the osteoporotic spine is a challenging surgery because of the bone quality and long outcome.* ***Objectives:*** *Evaluating the early outcome of spinal fusion on the osteoporotic spine with polymethylmethacrylate augmented conventional pedicle screw.* ***Methods:*** *Samples were patients having spinal fusion on the osteoporotic spine with lumbar T-score below -2.5 as defined by WHO. Thoracolumbar instrumented fusion included posterolateral fusion and posterior lumbar interbody fusion, with polymethylmethacrylate (PMMA) augmented conventional pedicle screw to raise pull out strength.* ***Results:*** *From October 2018 to February 2019, we treated 9 patients who had an indication of spinal fusion with the osteoporotic spine. The patient sample included 5 men and 4 women with an average age of 68.22 years (range 59 – 78). The indicated surgery was lumbar spondylolisthesis, lumbar stenosis, lumbar compressed fracture. The mean T-score was -2.87 (range (-3.4) – (-2.5)), All patients improved the symptoms after surgery (mean of VAS score pre-op (9.11) vs post- op (3.22)). No patient had an infection, neurological injuries, complications of cement injection, or putting screws.* ***Conclusion:*** *Polymethylmethacrylate augmented conventional pedicle screw is a safe surgery for spinal fusion on the osteoporotic spine to make strong-armed fusion and to avoid pull-out of traditional screws. However, we need longer to follow up and more samples to demonstrate the evidence.*

Keywords: *Spinal fusion, osteoporotic spine, polymethylmethacrylate*

I. INTRODUCTION

Osteoporosis is a skeletal metabolic disorder that damages bone strength, leading to an increased risk of bone fractures. The strength of the bone includes the integrity of both the bone mass content and the quality of the bone. Bone mass is represented by Bone Mineral Density-BMD and Bone Mass Content (Bone Mass Content-BMC). Bone quality depends on bone volume, bone microstructure (bone matrix and minerals), Bone Turnover (bone microstructure injury, and bone repair structure).

With the rapid growth of the global elderly population, osteoporosis has become one of the most prevalent public-health concerns and a major medical problem among them. The age of patients needing spine surgery is also increasing steadily as the average lifespan increases. Therefore, the number of spine operations in osteoporotic elderly patients is rising [1]. The advancement of surgical and anesthetic knowledge and technology allows the use of more sophisticated instrumentation and makes it possible to operate successfully on high-risk patients of advanced age who no longer accept disabling physical conditions.

The risk of performing spinal fusion on osteoporotic patients is that fixed instruments may be loosened or pulled out from the spine. Therefore, there have been many methods of spinal fixation on osteoporotic patients. Augmenting conventional pedicle

screws with polymethylmethacrylate (PMMA) is a technique to increase the fixed instruments' holding ability. Polymethylmethacrylate (PMMA) is injected into the vertebral body through the hole in the screw, spreading around the screw to hold the screw tight to the bone, increasing the pullout strength of pedicle screw up to 119 -250%.

Can Tho Central General Hospital has performed many kinds of spinal surgery techniques since 2008; however, augmenting conventional pedicle screws with polymethylmethacrylate (PMMA) on osteoporotic patients has only been performed since October 2018. We have done this study to evaluate the early treatment results of spinal fusion surgery in patients with osteoporosis.

II. METHODS

2.1. Study population and settings: Study population was patients who had an indication of spinal fusion on the osteoporotic spine with lumbar T-score -2.5 and below. Thoracolumbar instrumented fusion performed on the Patients involved posterior fixation or posterior lumbar interbody fusion (PLIF) with polymethylmethacrylate (PMMA) augmented conventional pedicle screw to raise pull-out strength.

2.2. Study design: Descriptive study.

2.3. Study contents:

Clinical and Radiological characteristics: number of patients, sex, age, diagnosis, number of level lesions, location of lesions, T-score. The osteoporotic spine was defined as one with lumbar T-score -2.5 and below. The T-score was measured by using Dual Energy X-ray Absorptiometry (DEXA) before surgery in the lumbar spine. The T-score index demonstrated osteoporosis situation.

Surgery: Details of surgical procedures for patients were all recorded. Varieties such as related diseases, menopause, lifestyle, level of fusion, time of surgery, blood loss….were not analyzed.

The radiological outcome was evaluated by spinal radiographs or CT scans postoperatively in all patients. The complications of augmenting conventional pedicle screws with polymethylmethacrylate such as spinal compression, cement leakage, pulmonary embolism were all considered. All complications of spinal surgery were also well-noted. Surgical site infection was defined as two types including deep and superficial infection. The good result was a decrease in the visual analog scale (VAS) after surgery (on discharge time) as compared to that before surgery and a good radiograph or CT scan. On the contrary, the bad result is unchanged or worse VAS score as compared to that before surgery and/or failing instruments on radiograph or CT scan.

2.4. Statistical analysis: The data has been analyzed by SPSS 20.00.

2.5. Ethics approval: The study's purpose was well-explained to all participants and they agreed to join the study voluntarily. All patients' information has been kept secret.

III. RESULTS

There were 9 patients participating in this study in total. The patient samples included 5 men and 4 women. The mean age was 68.22 years (range 59 – 78 years). Spinal diseases were lumbar spondylolisthesis in 3 patients (33.3%), lumbar stenosis in 4 patients (44.4%), and lumbar compressed fracture in 2 patients (22.2%). There were 6 patients having the surgeries on 1 level (66.7%), 3 patients on 2 levels (33.3%), and none on 3 levels or more. All details of patients above were summarized in Table 1.

Table 1. Clinical data of patients undergoing augmenting conventional pedicle screws with polymethylmethacrylate (PMMA).

Variable	Value (%)
Number of patients	9
Age (mean)	68.22
Sex (Male/Female)	5/4
Spinal diseases Lumbar Spondylolisthesis Lumbar stenosis Lumbar compressed fracture	 3(33.3) 4(44.4) 2(22.2)
No. of level lesions	
1 level	6(66.7)
2 levels	3(33.3)
3 levels and more	0 (0)

In more detail, among the spondylolisthesis cases, there was 1 case in L4-L5-S1, 1 case in L5-S1. While in lumbar stenosis, we had 2 cases in 1 level L4-L5, 1 case in L3-L4-L5, and 1 case in L4L5S1. Both of the two cases diagnosed with lumbar compressed fracture had 1 level in L1.

Table 2. Details of level lesions.

Spinal disease	Level	Surgery	Value (%)
Lumbar spondylolisthesis	L4-L5-S1 L5-S1	PLIF* PLIF	1(11.1) 2(22.2)
Lumbar Stenosis	L4-L5 L3-L4-L5 L4-L5-S1	PLIF PLIF PLIF	2(22.2) 1(11.1) 1(11.1)
Lumbar compressed fracture	L1 T10,T12	Posterior fixation Posterior fixation	1(11.1) 1(11.1)

**Posterior Lumbar Interbody Fusion (PLIF)*

DEXA BMD examination performed preoperatively showed a mean T-score of -2.87 (-3.4 to -2.5) and the T-score was recorded from the spine in all cases. The early clinical outcome was shown by the difference of visual analog scale (VAS) before and after surgery. The VAS is shown in Table 3.

Table 3. VAS score before and after surgery.

Spinal disease	VAS before surgery	VAS after surgery
Lumbar spondylolisthesis	9	3
Lumbar stenosis	9.25	3.5
Lumbar compressed fracture	9	3

The radiological outcome was evaluated by spinal radiographs or CT scans postoperatively in all patients. There was no appreciable screw loosening or migration on CT scans. There was no sign of radiolucency around the pedicle screws on plain radiographs and spinal CT scans. The kyphotic angle was significantly decreased after surgery in all patients treated for vertebral fracture. The kyphotic angle was improved from an average of

31° to 23° (because the index fracture was L1). No case had spinal compression, significant cement leakage, pulmonary embolism.

The early surgery complications were carefully considered. Infection or neurological damage was not seen.

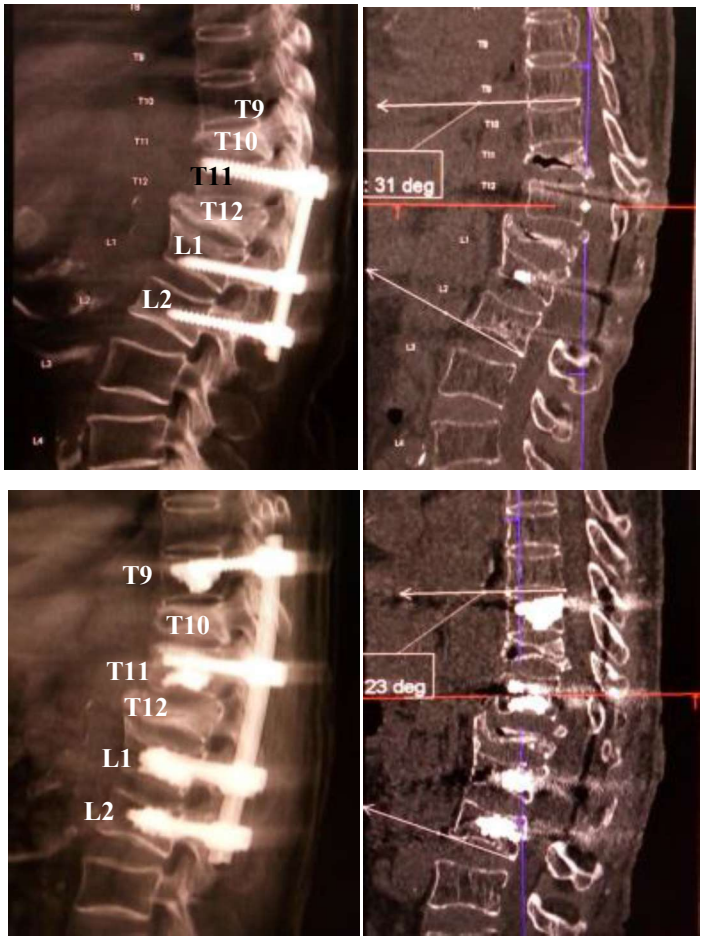

Figure 1. The patient had been operated once before due to the spinal compressive fracture. Above is the spinal CT scanner before the second surgery. He underwent another surgery for spinal fixation with PMMA augmented conventional pedicle screws to fix the kyphosis (below)

IV. DISCUSSION

There were 5 males and 4 female participants. The mean age was 68.22 years (range 59 – 78 years). All of them were the elderly. The number of elderly patients requiring thoracolumbar and lumbar fusion is rapidly growing as life expectancy increases. Most of the patients had spondylolisthesis or stenosis while two of them had a compressive fracture. All of them needed a pedicle screw fixation. However, the stability of the fixation depends on screws in the pedicle and vertebral body. Although pedicle screw instrumentation has become extremely popular over the last decade yielding favorable clinical and radiological outcomes for such patients, major concerns are osteoporosis-related problems such as screw pullout, screw loosening, and fusion failure. Because the pullout strength of regular screws

depends on the quality and quantity of the vertebral cancellous bone, fixation failure is likely to happen in elderly patients with osteoporosis. The pullout and loosening of the pedicle screws, resulting from the failure of screw fixation remains a significant clinical problem. Especially, patients with poor bone quality may lose the sagittal alignment or get nonunion, with more frequent screw movements within the vertebra than within the normal spine, leading to a failure rate of 0.6%–11% [4]. As in this study, the mean T-score was -2.87 (-3.4 to -2.5). Cement augmented pedicle screw techniques have been used clinically to improve pedicle screw fixation in the presence of compromised bone. Many experimental studies have proved that the stiffness and strength of pedicle screw fixation can be increased when the pedicle screw is augmented with various types of cement. The optimum augmenting methods of pedicle screw fixation strength continue to be debated, but polymethylmethacrylate is the most widely used method in Vietnam.

Polymethylmethacrylate augmented screws are reported to offer a higher resistance to pullout forces than standard screws, with the average pullout resistance ranging from 150% to 250% of that of standard screws [4]. Injection of cement into the vertebral body during its liquid phase presents the potential for leakage, increasing the risk of neural injury and pulmonary embolism. In our study, all patients improved VAS score after surgery (from 9-9.25 to 3-3.5). There was no sign of radiolucency around the pedicle screws on plain radiographs and spinal CT scans. No cases had spinal compression, significant cement leakage, pulmonary embolism. So in this study, all participants had good early results in both clinical and radiological aspects. However, long-term risks are the presence of cement compression in the spinal canal, the increased risk for adjacent-segment fractures, and the possibility of providing a host for infection. Moreover, to evaluate the advantages and limitations of PMMA with screws, further clinical and radiological studies should be conducted to provide comparisons between this method and the others.

V. CONCLUSIONS

This study suggests that the use of PMMA with screws is a safe, reliable technique in patients with osteoporosis who need posterior spinal fixation. The increased fixation strength may prevent screw pullout in patients with osteoporosis and in pedicle screw revision surgery. The improvement in holding power may improve patient outcomes and possibly result in fewer implant-related complications. Further clinical and radiological studies should be conducted so as to compare the efficacy of the method with that of the others.

Conflict of Interest: The authors declare that they have no conflict of interest.

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CAUSES, RELATED FACTORS AND EVALUATION OF TREATMENT RESULTS OF ACUTE PEDIATRIC POISONING IN CHILDREN AT CAN THO PEDIATRICS HOSPITAL FROM 07/2016 TO 05/2017

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ABSTRACT

Background: *Pediatric poisonings are common accidents that may lead to death or leave long-term complications. If the poisoning is detected and treated in time, the patient can be saved without severe complications. On the contrary, if the poisoning is diagnosed in its later stages or wrong treatments are provided, the patient will be at high risk of fatality.* ***Objective:*** *Studying on causes, related factors, and evaluating the treatment results of acute poisoning in children at Can Tho Pediatric hospital from 2016 to 2017.* ***Materials and method:*** *The cross-sectional descriptive study on 62 patients diagnosed with acute poisoning and hospitalized at Can Tho Pediatric hospital from 07/2016 to 05/2017.* ***Results:*** *Among 62 cases of acute poisoning, children under 5 years of age account for 72.6% of the total and the male to female ratio is 1.48:1. The main reason is the carelessness of the parents (90.3%). The main causes of pediatric poisoning are chemicals (mainly petroleum, pesticides, and detergents), which account for 59.7% of the cases. Poisonings were more common among less than 10-year-old children who are male, have blue-collar mothers with poor education. The majority of patients were cured (88.7%), 95.2% of which have a treatment period of fewer than 7 days.* ***Conclusions:*** *The main causes of pediatric poisoning are chemicals. Poisoning is common among children living in low-income families with blue-collar parents, which explains why they do not have enough time to care for their children.*

Keywords*: Acute poisoning, children, related factors.*

I. INTRODUCTION

Pediatric poisonings are common accidents among children, which could lead to death or leave long-term complications. If the poisoning is detected and correct treatment is administered in adequate time, the patient can be saved without severe complications. On the other hand, if the condition is detected too late or the poisoning is treated incorrectly, especially in the first aid step, it could be fatal to the affected children. According to a report from the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) on children's harm prevention in 2004, acute poisoning caused more than 45,000 deaths in children and adolescence under the age of 20. In high and medium-income countries. Poisoning the fourth most common unintentional cause of death, after vehicle crashes, burns and drowning, with the prevalence of poisoning being 0.5 per 100,000 people. However, there is no clear statistical record of pediatric poisonings in Can Tho city. This is