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Effect of Preoperative Embolization on the Intraoperative Bleeding during Posterior Stabilization in Thoracolumbal Fracture Cases at Prof. Dr. R. D Kandou Hospital Manado

Nathaniel E. Pali,[1] Tommy Suharso,[2] Richard Sumangkut,[3] Billy Karundeng,[3] Djony E. Tjandra,[3] Yuansun Khosama,[3] Windy M. V. Wariki[4]

[1]Faculty of Medicine, Universitas Sam Ratulangi, Manado, Indonesia
[2]Division of Orthopedic Surgery, Department of Surgery, Faculty of Medicine, Universitas Sam Ratulangi, Manado, Indonesia
[3]Division of Vascular and Endovascular Surgery, Department of Surgery, Faculty of Medicine, Universitas Sam Ratulangi, Manado, Indonesia
[4]Department of Community Medicine, Faculty of Medicine, Universitas Sam Ratulangi, Manado, Indonesia
Email: nathanielpali013@student.unsrat.ac.id
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Abstract: Embolization is a technique to stop or prevent bleeding by inserting an object, such as an air-filled membrane (balloon), or an embolic material such as foam into a blood vessel to block the blood flow. This study aimed to prove that preoperative embolization might affect and reduce the amount of intraoperative bleeding during the posterior stabilization procedure for thoracolumbal vertebrae fracture. A quasi-experimental method was chosen for this study, and samples were not taken at random. Samples were patients with thoracolumbal vertebrae fracture who underwent the posterior stabilization procedure. Samples were divided into two groups, treated with and without preoperative embolization groups. The treatment was given 24-48 hours before posterior stabilization procedure. The intraoperative bleeding was measured in milliliters. The resulys showed that the average intraoperative blood loss was 283.3 mL, meanwhile of the untreated group was 583.3 mL. The one-way t-test resulted in a p-value of 0.004 at 5% of significance. In conclusion, preoperative embolization could reduce the amount of blood loss during intra-operative posterior stabilization in patients with thoracolumbar vertebral fractures. Further research on preoperative embolization in patient who will undergo posterior stabilization surgery of the thoracolumbal region due to fracture, either mechanically or generatively, is needed.
Keywords: preoperative embolization; intraoperative blood loss

INTRODUCTION

Embolization is an effective way to control bleeding and limiting supply bleeding for mass tumors. Embolization could be beneficial as a definitive treatment or as an adjuvant management for the next surgery. Arteriovenous fistula (AVF) or pseudoaneurysm embolization with preservation of main arteries, as well as embolization preoperative tumor is the main purpose to do preoperative embolization. For the trauma itself, the operation was done once in the cervical area and then to correct scoliosis there were two steps (two days). On the first day they did the first step of correction with intraoperative embolization and on the second day they continued to second step of scoliosis correction where intraoperative bleeding at the second day was less compared to of the first day. Preoperative embolization before posterior stabilization in the thoracolumbal vertebrae has never been done in Indonesia, so far.[1-29]

A permanent embolization material, polyvinyl alcohol (PVA), works like fluid and enters the blood vessels. This PVA will harden and give permanent occlusion in the blood vessel stream. Particles of PVA cause permanent occlusion of blood vessels with sticking to the walls of the vessels resulting in generalized blood obstruction, inflammatory reaction and focal angionecrosis with the formation of fibrosis in the blood vessels. The PVA particles vary from 100 microns up to 1100 microns. The disadvantages of PVA itself i.e. PVA can degraded to the proximal area of embolization target, therefore, there is a small possibility to cause various complications like post embolization syndrome and Brown-Sequard syndrome.[29-34]

One of the complications of posterior stabilization is intraoperative bleeding. The intra-operative bleeding must be treated or controlled as soon as possible for a better postoperative outcome. Therefore, the aim of this study is to evaluate whether preoperative embolization could reduce intraoperative bleeding during the posterior stabilization procedure in thoracolumbal vertebrae fracture in order to minimize the risk of operation. This problem will be our challenge in the modern surgery to try new intervention or modern technology for a better outcome.

METHODS

This was a quasi-experimental study that compared two groups. Group one was treated with preoperative embolization 24-48 hours prior to the posterior stabilization procedure and group two was untreated with embolization. We compared the amount of intraoperative bleeding of the two groups. The intraoperative bleeding was measured in milliliters. In this study we choose concecutively instead of random the group due to intervention group just have 3 samples. In the other group we have 15 samples that we randomized using simple random sampling. The data were analyzed with one-way t test. This research was done when the researcher got permission and ethical clearance from Health Research Ethics Committee RSUP Prof. Dr. R. D. Kandou Manado.

RESULTS

There were 18 patients who fulfilled the inclusion and exclusion criteria, and participated in this study. Samples were collected from January 2021 to May 2022. Of 18 patients there were 11 males (57%) and seven females (43%). Three of the 18 patients were treated with pre-operative embolization and were chosen by using the consecutive sampling technique meanwhile the other 15 patients untreated with pre-operative embolization were sampled by using simple random sampling technique. Based on the age distribution, the mean age of samples was 52 years, ranging from 25 years to 74 years.

The mean intraoperative bleeding was 583.3 mL in patients untreated with embolization, and 283.3 mL in patients treated with preoperative embolization. The most amount of bleeding in untreated patients was 750 mL, while in the treated patients was 600 mL. The least amount of intraoperative bleeding in untreated patients was 400 mL while in the treated patients was 200 mL.

The effect of preoperative embolization on the intraoperative bleeding in patients with thoracolumbar posterior stabilization was analyzed using the one-way T test resulting in a p-value of 0.004 at 5% of significance. This showed that preoperative embolization could affect the

amount of intraoperative bleeding.

The p-value of this study was less than 0.05 (at a significance of 0.05) which meant that the hypothesis H1 was accepted. So, it could be concluded that preoperative embolization could be related to the amount of intraoperative bleeding in the posterior stabilization procedure for thoracolumbal vertebrae fracture.

DISCUSSION

The first patient underwent the posterior stabilization procedure of the 4-7th thoracal and 4-5th lumbar vertebrae. The preoperative embolization was performed to block the 2nd of right posterior radicular artery with PVA of 250-355 micron using a micro catheter with a diameter of 1 fr up to 2.5 fr. After the embolization, the intraoperative bleeding during posterior stabilization procedure was 200 mL. The vascularization for the vertebrae is derived from the radicular arteries surrounding the vertebral region posteriorly around the circular arterial lamina which are also connected to the posterior spinal artery that connects the vascularization of posterior area vertically. Therefore, although the posterior radicular arteries were blocked selectively, the vertebrae could still get vascularized from the posterior spinal artery.[1-9,35-49]

In the second patient, we performed the posterior stabilization procedure of the 4-5th lumbar vertebrae. The preoperative embolization was performed to block the 2nd of right posterior radicular artery with PVA of 250-355 micron using a micro catheter with a diameter of 1 fr up to 2.5 fr. After embolization, the intraoperative bleeding during posterior stabilization procedure was 200 mL. In this patient likewise, the bleeding could be reduced because the posterior radicular arteries were blocked, while vascularization from the posterior spinal artery still continued.[1-9,35]

Compared with the previous posterior stabilization procedure, the amount of intraoperative bleeding in a similar area like the two samples is reduced. This is supported by Tuchman et al[35] that during the 2nd step of operation (24 hours after embolization) the amount of intraoperative bleeding was less than the first step. The 2nd patient got muscle weakness after the posterior stabilization procedure but it was getting better with practice in a period time of one week. The cause of post embolization temporary muscle weakness is not clear yet. The possibility is the existence of the embolan escaped to a higher level, therefore, it reduced the vascularization to the spinal cord resulting in temporary muslce weakness, or the effects of trauma when the posterior stabilization procedure was performed.[1- 9,34,35,39-49]

As for the third patient, we performed the posterior stabilization procedure of the 7th thoracal vertebra. The preoperative embolization was performed to block the right posterior radicular artery of the 5th thoracic vertebra and the left posterior radicular artery of the 9th thoracal vertebra using PVA of 250-355 micron in diameter and a micro catheter of 3.0 fr and distal of 2.4 fr (150 cm x 30 cm). The amount of intraoperation bleeding was 450 mL, and there was no complication found after the procedure.

CONCLUSION

Preoperative embolization could reduce significantly the amount of intraoperative bleeding during posterior thoracolumbar vertebral stabilization.

Further studies with greater sample size are needed to achieve better knowledge and expertise in performing preoperative embolization, especially in the spinal area.

Conflict of Interest

The authors affirm no conflict of interest in this study.

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