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Successful angioembolization with autologous subcutaneous fat in an open book pelvic fracture

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Abstract:

Arterial bleeding due to pelvic fracture can be life-threatening, and angiographic embolization is the gold standard for its control. Various materials have been described, but most of them are not widely available, mainly because of the high costs. Here, we report a case of use of autologous subcutaneous fat tissue for successfully controlling bleeding in a patient with an anterior-posterior pelvic fracture.

Keywords:

Embolization, open book, pelvic fracture, subcutaneous fat, trauma

Introduction

Bleeding due to pelvic fracture is associated with a high rate of mortality regardless of the fracture type.^[1] Although the source of bleeding is mostly venous, it can originate from arteries or bones. Arterial bleedings are more likely to be associated with anterior-posterior pelvic fractures.^[2] To date, various treatment options are described, including pelvic packing, external fixation, Resuscitative Endovascular Balloon Occlusion of the Aorta, and angioembolization.^[3-5] These methods may be used alone or in combination depending on the severity of injury and bleeding. Pelvic angioembolization is state-of-the-art in hemorrhage control in pelvic fractures.^[6] However, most of the embolizing agents are expensive and not widely available. Here, we describe a case report where pelvic bleeding control was achieved with angioembolization using

autologous subcutaneous fat tissue as the embolizing agent.

Case Report

A previously healthy 38-year-old male was hit by a car and brought to the Emergency Department by the Emergency Medical Service. On arrival, he was awake and alert, with a Glasgow Coma Scale of 15 and an Injury Severity Score of 9. His blood pressure was 125/73 mmHg with a heart rate of 96 beats/min (shock index = 1.3), and the oxygen saturation was 96% in room air. The patient had an odor of alcohol and stated that he could not remember what happened. Physical examination revealed tenderness in the lower abdomen, a laceration of 4 cm over the right anterior superior iliac spine, and a swollen, painful right knee. Focused Assessment with Sonography in Trauma examination indicated minimal free fluid around the bladder. Serum lactate, hemoglobin, and base deficit levels were 7.6 mmol/L, 11.5 g/L, and -12, respectively. To mitigate the risks of possible pelvic bleeding, a circumferential sheet was applied for pelvic stabilization.

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The patient then underwent an emergency contrast-enhanced whole-body computed tomography (CT) scan of the head, neck, chest, abdomen, and pelvis. Pelvic CT revealed a Type B1 open book pelvic fracture according to the Tile classification, along with a hemorrhagic area adjacent to the right obturator muscle extending to the retroperitoneal space. A pelvic arterial angiogram indicated two different contrast extravasations from the branches of the right obturator artery [Figure 1]. After a nontargeted proximal embolization with Gelfoam, the extravasation resolved, and the patient was transferred to the critical care unit. After resuscitation with two bags of packed red blood cells and one pack of fresh frozen plasma, base deficit began to improve, however, an expected elevation in the hemoglobin level could not be achieved, which might be indicating a re-bleeding. To detect a re-bleeding and if present, to control the bleeding, we transferred the patient to the angiography suite once again [Graph 1]. We did not want to face the risk of inadvertent ischemia once again with another temporary, nontargeted embolization with Gelfoam. However, permanent embolization materials, including micro-coils or vascular plugs, in size appropriate for the patient's bleeding artery were not available at that moment. Therefore, we cannulated the culprit artery in a rather selective fashion with a 5 Fr microcatheter, and through it, we threaded three pieces of subcutaneous fat tissue obtained from the left femoral zone and sliced to small particles. The "blush" was resolved after a successful embolization [Figure 2]. The patient was transferred to the ward for planned elective surgery.

Discussion

Pelvic angioembolization is effective for bleeding control in pelvic fractures. Various types of embolizing materials are available, including coils, plugs, particles such as gelatin sponge, and liquid substances such as polyvinyl alcohol and N-butyl cyanoacrylate. However, most of these agents are not widely available in every institution, mainly because of the high costs. By contrast, the Gelfoam is rather cheap with a quick, nonselective bleeding control profile, which makes it a reasonable choice for embolization, particularly in an emergency setting.^[7] However, Gelfoam allows only temporary hemorrhage control and has a higher rate of rebleeding than permanently embolizing agents.^[8]

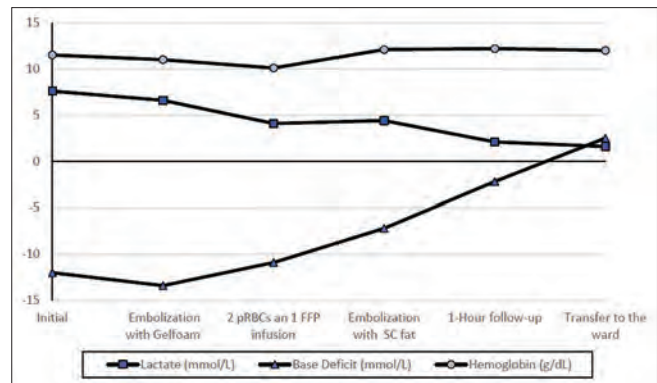
As bleeding control is one of the basic tenets of trauma resuscitation which must be addressed proactively, lack of an expected elevation in hemoglobin levels despite blood transfusion raised our suspicions of a re-bleeding. Furthermore, we wanted to avoid the risks of a possible massive transfusion protocol in case of the bleeding control could not be achieved. Although the vital signs of the patient were in normal limits after blood transfusion, base excess level was -7, which indicated the patient is still having a hemorrhagic shock^[9] [Graph 1]. Thus, we



Figure 1: Extravasation from the bleeding artery



Figure 2: Control angiogram after embolization with the fat tissue



Graph 1: Hemoglobin, lactate and base excess levels during the entire resuscitation period. pRBCs: Packed red blood cells, FFP: Fresh frozen plasma, SC: Subcutaneous

took the patient to the angiography suite once again for a control angiography to investigate whether a re-bleeding occurred.

Autologous fat embolization is recently being used, especially in units lacking resources. Only a few case

reports are available on this method, and they all describe its use for 'repair' when complications arose during or just after an angiographic intervention. Following an aortic and mitral valve replacement in an 84-year-old female, Tokuishi *et al.*^[10] used subcutaneous fat embolization to control bleeding from a bronchial artery after weaning from cardiopulmonary bypass. In two similar case reports, He *et al.*^[11] and Çağdaş *et al.*^[12] successfully used this method to manage coronary artery perforation during percutaneous coronary angiography. Recently, Ari *et al.*^[13] used subcutaneous fat embolization for treating a renal artery perforation during percutaneous nephrolithotomy. In contrast with these reports, we used this method not for treating a complication but the situation itself.

The major setback of this method is the preparation of the fat tissue in an appropriate size to be threaded through a microcatheter may be time-consuming and not viable in a hemodynamically unstable patient. Our patient was hemodynamically stable throughout and was safely transferred to the ward without a complication associated with angiography and embolization. However, further studies on this method are needed.

Conclusion

Autologous fat embolization seems to be cheap and effective for bleeding control and maybe an option in units with lacking resources. However, further studies are needed to justify this method.

Author contribution statement

Y.E.Ö., M.A., and S.E.D. contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript. S.E.D. took responsibility of data collection, patient follow-up and reporting. Y.E.Ö. and S.E.D. took responsibility in the literature review. Y.E.Ö., M.A., and S.E.D. participated in conceptualizing the idea and constructing the manuscript. Y.E.Ö. and M.A. performed the critical review. All authors reviewed and approved this submitted manuscript.

Conflicts of interest

None Declared.

Consent to participate

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal.

The patient understand that name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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