

# Severe complications after intravascular application of bone cement and hemostatic agent during posterior spinal surgery

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## Abstract:

**Purpose:** Posterior surgical approaches to the lumbar spine may cause vascular injuries because of their proximity to the large abdominal and pelvic vessels.

**Case report:** We describe three patients with intraarterial and intravenous application of bone cement and/or hemostatic agents during posterior surgical approach to the lumbar spine. One patient required urgent thrombectomy after acute iliac artery occlusion with severe leg ischemia. One patient received infrarenal aortic repair and bilateral infragrenal bypasses after severe bilateral ischemia due to acute thrombosis of the infrarenal aorta. This patient died on day 3. One bone cement embolization of the inferior vena cava was treated conservatively.

**Conclusion:** The use of bone cement and hemostatic agents when arterial bleeding occurs can lead to unnoticed application in large vessels with devastating outcome. Early diagnosis and prompt re-vascularization is crucial. Intravascular solid cement plug and foamy reaction of the hemostatic agents allows very limited endovascular treatment options.

## HIGHLIGHTS

Intravascular application of hemostatic agents or cement can have fatal outcome.

During lumbar surgery in prone position ischemia or relevant bleeding can be missed.

Being aware of this complication can change the approach when bleeding occurs.

## INTRODUCTION

There is a low risk (0.1%) for vascular complications in spinal surgery.<sup>1</sup> However, in the lumbar spine area large vessels are in proximity, thus increasing the risk for vascular injury. The risk seems to be higher during posterior approach in the lumbar area.<sup>2, 3</sup> Different mechanisms can lead to injury of the large vessels: transpedicular drill holes, use of graspers during disc surgery and/or mal-positioned screws.<sup>2, 3, 4</sup> In spinal surgery the fractured or osteoporotic vertebral bodies are filled with bone cement and hemostatic agents are often used, when smaller venous bleeding occurs after drilling. We report three cases with accidental intravascular application of bone cement and hemostatic agents during posterior spinal surgery in prone position.

## REPORT I

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ISSN 1106-7237/ 2019 Hellenic Society of Vascular and Endovascular Surgery Published by Rotonda Publications All rights reserved. <https://www.heljves.com>

A 56-year-old year old female required re-do decompression due to re-stenosis of the neural foramen L3-L4 with left-sided radicular leg pain. After decompression via posterior approach in prone position, massive bleeding started from a right-sided pedicle screw hole after removal of an old screw. Hemostatic agents (Surgiflo®, Ethicon and Traumastem®, Bioster) were used to control the bleeding. After completion of procedure the patient had right-sided acute lower limb ischemia. Computed tomography angiography (CTA) revealed an occlusion of the right common iliac artery (CIA) with intra-arterial air. (Figure 1A). The empty screw hole reached the right CIA. Immediate balloon-embolectomy of the iliac and femoral vessels from the groin restored circulation to the leg. Foamy looking tick thrombus was removed. Intraoperative angiography showed no bleeding from the iliac vessel and extensive embolization of multiple small arteries in the leg. (Figure 1B)

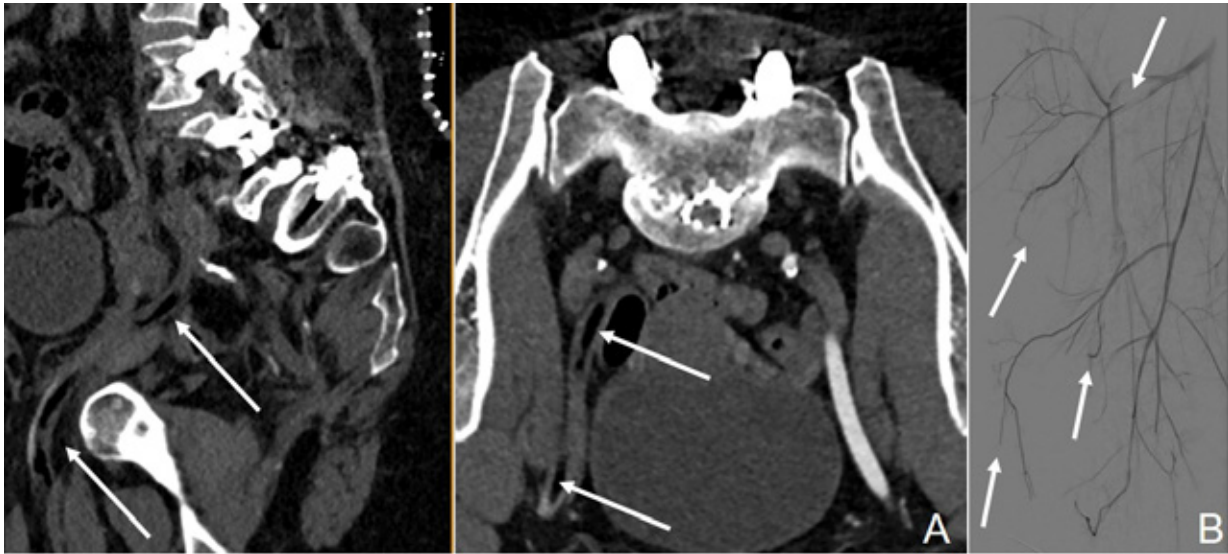
The postoperative course was uneventful and the patient was discharged with single antiplatelet therapy. After one year all vessels in the right leg were patent and the pedal pulses palpable, but the patient reported severe claudication in leg. This claudication might have vascular origin due to embolization of very small arteries without sufficient collaterals or a neurologic origin arising from the lumbar degeneration.

## REPORT II

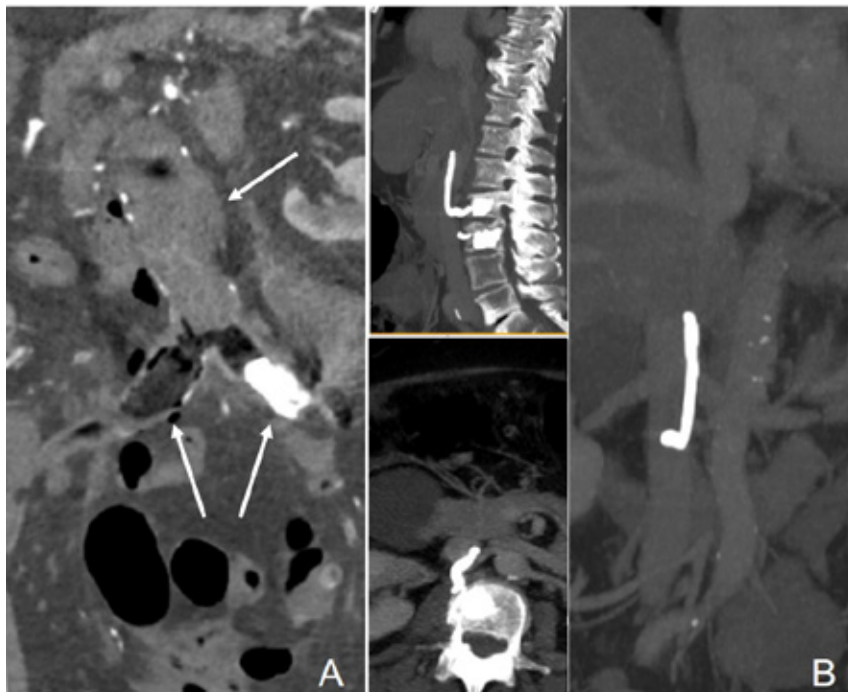
A 72-year-old-female patient with chronic occlusion of both superficial femoral arteries required extended re-decompression at the level of L3-S1 with spondylodesis Th11-S2 and sacral vertebroplasty in prone position due to debilitating lumbar pain caused by pseudoarthrosis and sacral fracture. Massive bleeding occurred after removal of an old screw and stopped after application of hemostatic agents (Surgiflo® Ethicon; Tachosil® Takeda). Additional bone cement was ap-

plied in the drill hole for reinforcement of the new screw. After extubation the patient complained of continuous unmanageable pain in both legs. The CTA showed complete thrombosis of the infrarenal aorta and iliac arteries with intra-arterial presence of airy thrombus and bone cement. (Figure 2A). The left common iliac artery was perforated with the tip of a new screw. Simultaneous revascularization with bifurcated aorto-bifemoral graft, removal of cement and thrombus from the groin and infraglenal femoro-popliteal bypasses followed. After completion of the proximal anastomosis, shunts were con-

nected to the legs of the bifurcated graft and inserted in the right deep femoral artery and left below-knee popliteal artery. Massive foamy airy thrombus and cement was extracted from all occluded vessels. Massive muscle necrosis in both legs induced acute kidney injury resulting with extremely increased potassium level and malignant arrhythmias. Immediately initiated hemofiltration couldn't correct sufficiently the potassium blood level. The patient died due to multi organ failure on day three postoperatively.



**Figure 1.** A: Figure 1. A: preoperative computer tomography angiography with foamy airy thrombus (white arrows) in the thrombosed right external iliac artery; B: intraoperative angiography of the right deep femoral artery with residual foamy thrombus and occluded small peripheral arteries (white arrows)



**Figure 2.** A: Thrombosed infrarenal aorta with bone cement in the left and foamy thrombus (white arrows) in the right common iliac artery; B: bone cement plug in the inferior vena cava

### REPORT III

A 77-year-old female patient experienced spontaneous fracture and required bone cement vertebroplasty of L2-L3. After uneventful operation the postoperative CTA revealed a long cement plug beginning from the L2 vertebrae and ending in the inferior vena cava. (Figure 2B) This embolization probably occurred via unintentional direct puncture of the posterior wall of the inferior vena cava, thus explaining the plug continuity. There was no additional peripheral pulmonary embolization. The patient was discharged on anticoagulants.

### DISCUSSION

Large vessel lesion with bleeding after spinal interventions is a well-described complication.<sup>2,3</sup> Prompt diagnosis in prone position during posterior approach remains difficult. Endovascular treatment with stent-grafts is a good option in case of bleeding from large vessel and with embolization and coiling after bleeding from lumbar veins/arteries.<sup>4,5</sup> Misplaced screws with potential vessel involvement remain clinically silent. Re-do surgery with removal or screw exchange has higher risk for bleeding complications.<sup>1</sup> Routine CTA prior to re-do spine surgery with posterior approach might help revealing misplaced screws and avoid potential vascular complications. In cases with intraarterially placed screws, placement of a stent-graft could be an option to avoid bleeding after screw removal.

On contrary, large vessel occlusion after intravascular application of bone cement or hemostatic agents is a rare condition. Intravascular hemostatic agent causes extensive local reaction with foamy occlusion and peripheral embolization. Endovascular removal of this foamy thrombus or local lysis is questionable. Open surgery with balloon-embolectomy is a fast and good solution to retrieve the foamy thrombus from the vessel. The occlusion of small peripheral arteries with completely patent femoro-popliteal axis was probably the reason for severe leg claudication in the first patient.

There is no endovascular option to remove intravascular bone cement. In the second patient no wire or balloon-catheter passage was possible from the groin. The open access to large abdominal and iliac vessel with complete removal of intravascular cement plug remains the fastest option to restore circulation in lower extremities.

Due to its fixation to the vertebral body the intracaval cement plug ended without severe complication in the third patient. Potential lethal outcome could be expected if similar cement amount would end in the pulmonary vessels.

### CONCLUSION

In case of significant bleeding during re-do spine surgery, large vessel injury should be assessed before using cement and hemostatic agents as the intraarterial placement of these agents can be fatal. Hemostatic agents and cement should not be used without identification of the bleeding source. Early diagnosis and prompt re-vascularization is crucial.

*Funding: None*

*No conflict of interest.*

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