

## Complication after Embolization of Internal Iliac Artery by Gelatin Sponge Powder

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### ABSTRACT

A case is reported of muscular atrophy of the buttock and advanced and permanent neuropathy following embolization of the internal iliac artery by gelatin sponge powder. We discuss and review the risk of complications by embolic material and the method of embolization.

Transcatheter embolization can be applied to genitourinary hemorrhage symptoms such as abdominal injury, renal trauma by percutaneous biopsy, carcinoma in kidney, bladder or cervix, arteriovenous malformations and arteriovenous fistulas, and hemorrhage after prostatectomy and parturition. It is important, however, to choose carefully the method of transcatheter embolization and embolic material to be used, according to the purpose and organs.

Gelatin sponge is one embolic material used for a wide variety of clinical conditions. There are two types of gelatin sponge, plegets and powder (Fig. 1). Using gelatin sponge powder, we applied transcatheter embolization of the distal artery from the unilateral internal iliac artery to intractable bladder hemorrhage with the result that muscular atrophy of the buttocks had advanced and permanent peripheral neuropathy had developed as complications.

### CASE REPORT

The patient was a 50-year-old male. His chief complaints were gross hematuria and vesical tamponade with clots. There was nothing notable in his personal or family history. His present illness started from December, 1980 as asymptomatic gross hematuria but no treatment was given at that time. In February 18, 1982, asymptomatic gross hematuria and vesical tamponade with blood clots occurred. He consulted us for the first time on February 19, 1982 and

immediately hospitalized. In the hospital, he was treated with hemostatica and continuous vesical irrigation. However, inlying urethral catheter embolism with blood clots continued and it was necessary for him to be given frequent blood transfusion. In cystoscopic examination, we observed a broad based invasive tumor at the right lateral wall. However, as he was bleeding heavily, we could not determine the source of the bleeding. It was also difficult to stop the bleeding by transurethral fulguration. On February 25, 1982, we performed transcatheter embolization for the purpose of hemostasis. After pelvic arteriography, tumor vessels were found at the right lateral wall to be Stage T3 and wall thickened. Though we were not able to determine the source of bleeding, we thought it might be the vesical artery. A small amount of gelatin sponge powder was applied after placing an ordinary angiographic catheter with a hole at its tip to the distal portion of the right internal iliac artery (Fig. 2A). In the right internal iliac arteriography following embolization, arteries such as the superior gluteal, internal pudendal, obturator, and superior and inferior vesical arteries occluded at the peripheries (Fig. 2B). Though the bleeding stopped after the embolization, the patient began to complain of acute pains in his right leg and buttock. On the next day, the acute pain in the right leg changed to numbness. The severe gluteal pain, however, could not be relieved by ordinary analgesics and epidural

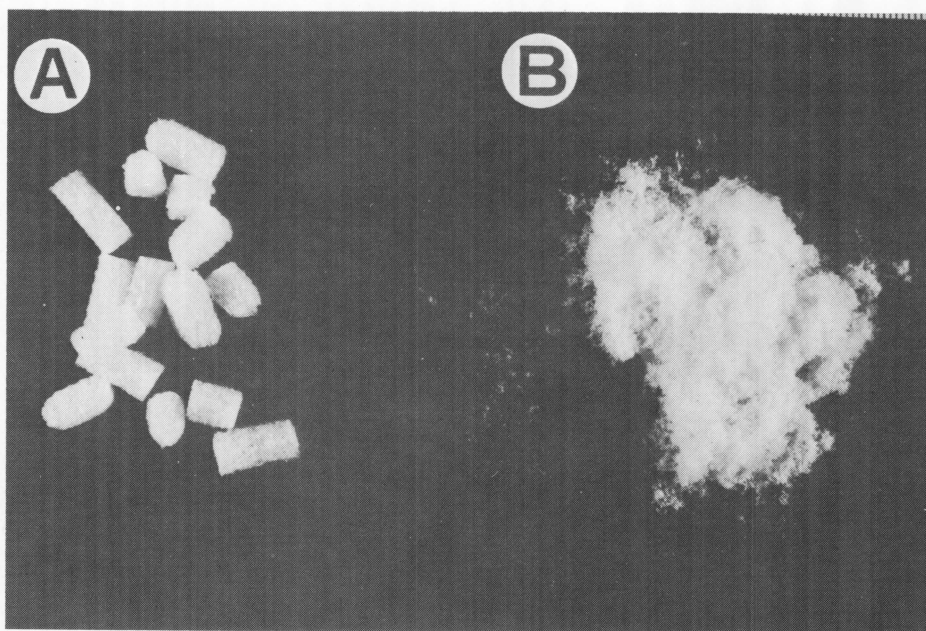


Fig. 1. Gelatin sponge. (A) Pledgets. (B) Powder.

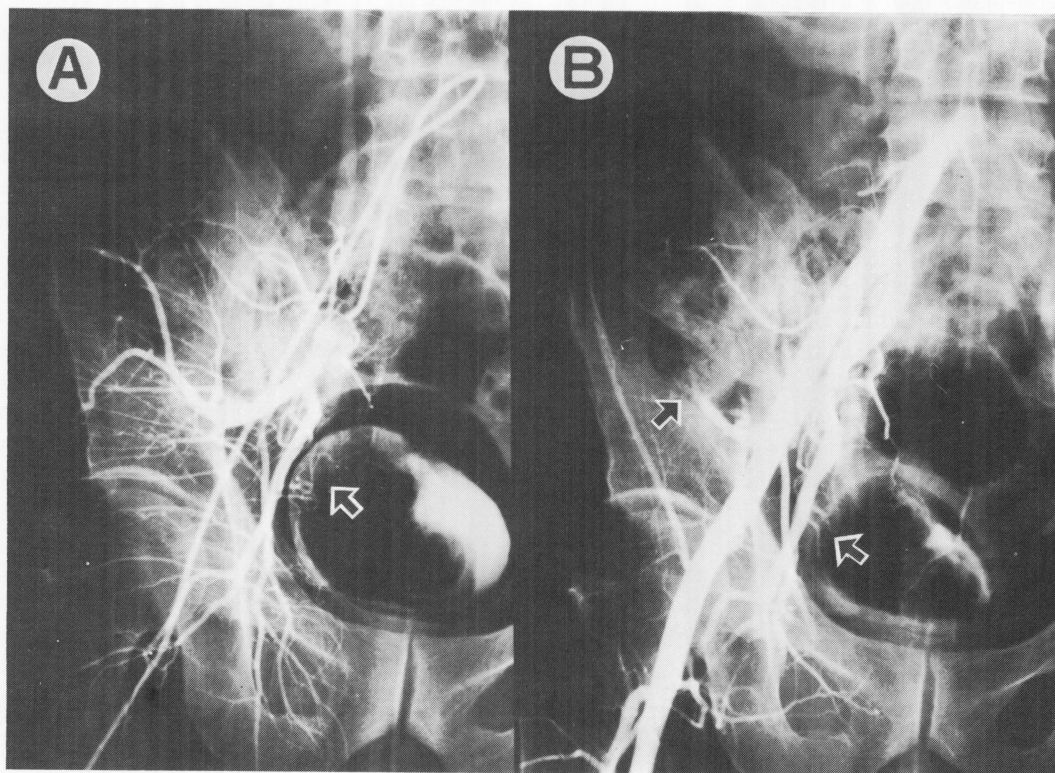


Fig. 2. (A) Right internal arteriogram before embolization demonstrates tumor vessels and thickening of bladder wall (arrow). (B) Right internal arteriogram following injection of gelatin sponge powder reveals occlusion of superior gluteal artery and major hypogastric branches at the peripheries (arrows).

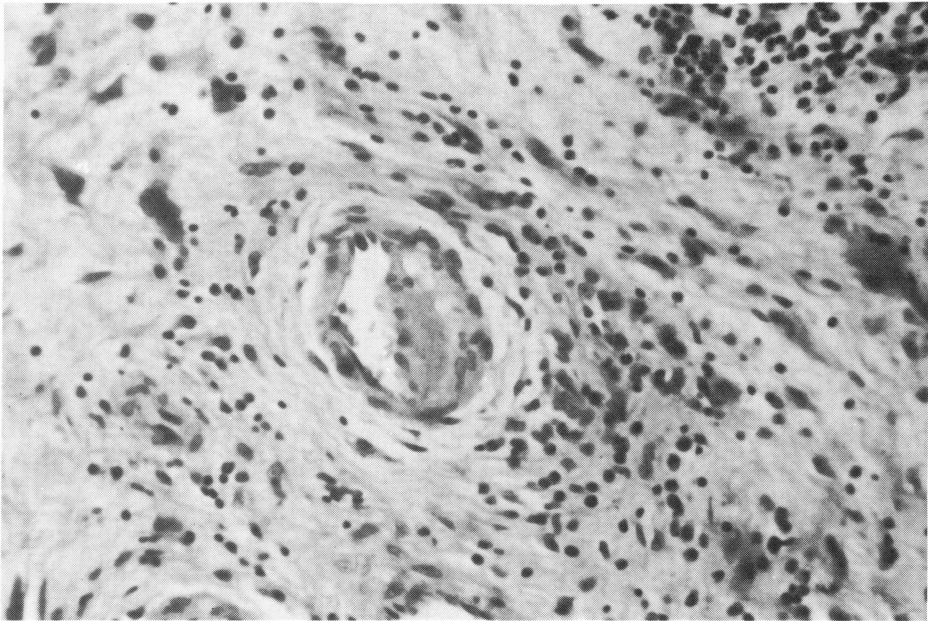


Fig. 3. Photomicrograph of the bladder wall near the carcinoma 33 days after occlusion. Lumen of the small artery is obliterated with gelatin sponge powder. Hematoxylin and eosin stain,  $\times 100$ .

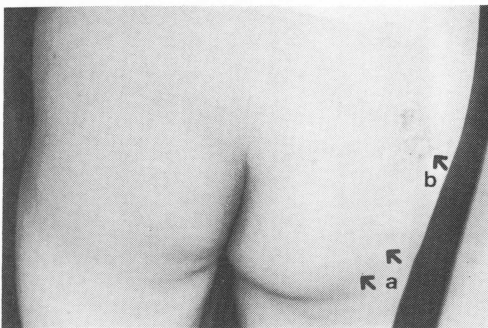


Fig. 4. View of the buttock demonstrating the muscular atrophy (a) and scar formation after erosion at right side (b) 3 months after embolization.

block was necessary for him. Swelling and tenderness in the right buttock, hypesthesia in the right L5, S1 and S2 area, and feebleness in right patellar reflex and ankle jerk were also observed. Twenty days after transcatheter embolization, the right gluteal pain had almost gone. The numbness and tingling in the area under the sciatic nerve and motor disturbance of the right

leg still remained. After treating him with 2,000 rads irradiation to the whole bladder, we performed a total cystectomy, pelvic lymphadenectomy and ileal conduit diversion for him on March 29, 1982. The pathological diagnosis was of transitional cell carcinoma and pT3b, G3, ly<sub>0</sub>, pN1. Also it was found that the lumen of small vessels of the bladder wall near the carcinoma was embolized with gelatin sponge powder (Fig. 3). For about two months after the operation, it was necessary for the patient to be given epidural block intermittently, vitamin B<sub>12</sub> for peripheral neuropathy in the right leg and rehabilitation treatment. Finally, his only symptom was numbness in the right leg and he could walk with crutches. He left hospital on June 5, 1983. At that time the muscular atrophy of right buttock and scarformation after erosion (Fig. 4) were still detectable. He is still under observation as an outpatient, and continues to receive B<sub>12</sub> and rehabilitation treatment.

#### COMMENTS

One of the genitourinary hemorrhage symptoms for which transcatheter embolization can be applied is bladder carcinoma<sup>2)</sup>. In bladder

carcinoma, there are two main types of case for which it is suitable; cases in which the objective is temporary hemostasis until surgical treatment can be given because there is massive hemorrhage from the tumor which is very difficult to arrest by medication and transurethral fulguration, and cases in which transcatheter embolization is performed with the expectation of a conservative effect to highly invasive bladder carcinomas which cannot be cured with radical operation<sup>5</sup>. In general, transcatheter embolization should be carried out after angiographic confirmation of bleeding arteries and veins. However, in the case of bladder carcinoma or carcinoma which directly invades the bladder from other organs, the source of bleeding may be difficult to determine. We can expect to arrest hemorrhage in these cases by embolization of the anterior division of the internal iliac artery<sup>7</sup>. However, as the majority of the bladder carcinoma patients are elderly and it is therefore likely that their intrapelvic arteries are convoluted, it is often the case that the tip of the catheter cannot be inserted in the internal iliac artery further than the diverging point of the superior gluteal artery and that not only the anterior division but also the superior gluteal artery are embolized at the same time. Actually, there are reports of the cases of temporary or chronic gluteal pain because of ischemia in the area supplied from the superior gluteal artery as the result of internal iliac artery embolization<sup>4,6,10,11</sup>. We have used gelatin sponge alone or with an anticancer agent in seven cases out of nine; for the other two, we carried out transcatheter embolization of one or both sides of the internal iliac artery, using 1-isobutyl-2-cyanoacrylate (IBC). In principle, we generally used pledgets as gelatin sponge except in one case in which we used powder. In all nine cases internal iliac artery including the superior gluteal artery was embolized. Three of nine cases complained gluteal pain. Gelatin sponge pledgets were used as embolic material in two of the three cases and gluteal pain disappeared in a few days in both cases. However in the one case in which gelatin sponge powder was used as embolic material, gluteal pain lasted for 20 days after embolization, causing peripheral neuropathy in the right leg. This long-lasting gluteal pain, atrophy of gluteal muscles

and skin erosion of the right buttock were apparently caused by peripheral embolus of the superior gluteal artery which impeded circulation of blood to the gluteal muscle group through collaterals. We can also speculate that peripheral neuropathy in the right leg was affected by ischemic change in the sciatic nerve around the obturator artery of which peripheral vessels were intercepted. In other words, we think it was caused not by ischemia in superior gluteal artery and obturator artery, but by long-lasting micro-vessel embolus at the periphery of those arteries and interception of vessels from collaterals to the muscular and nerve areas under those arteries, since we used such small particles as powder for the embolic material. There are other cases involving leg neuropathy which are similar to this one; one in which both complete paralysis with sensitive trouble of one limb and Brown-Sequard-like syndrome occurred after embolization of the internal iliac artery with IBC<sup>8</sup> and another in which gluteal pain lasted for 2 weeks after embolization of the internal iliac artery with gelatin sponge and sensory defects of the innervation area of the nervus peroneus was caused<sup>6</sup>. There have been no cases, as far as we know, in which neuropathy of the limb has derived from embolization of the internal iliac artery with gelatin sponge powder. Transcatheter embolization is applied for the treatment of a wide variety of clinical conditions. The choice of embolic materials is made after consideration of many factors; clinical conditions, the extent and period of embolus, technique according to the method of embolization, and hemodynamics and collateral circulation of target organs. Among various embolic materials, gelatin sponge (Gelfoam<sup>®</sup>) is the most popular, as it is easily obtained and handled. The size and the amount of gelatin sponge to be applied can easily be adjusted. Also, it becomes a highly compressible gelatin when mixed with physiological saline solution or contrast media, and passes through an ordinary angiographic catheter. This material helps not only physical embolus but also thrombogenesis and is absorbed into living tissue within 21 to 45 days<sup>9</sup>. Apart from the flat gelatin sponge pledgets (Gelfoam<sup>®</sup>), there is also gelatin sponge powder (Gelfoam<sup>®</sup> powder). The former is usually used as embolic material. Generally speaking, smaller particle



embolic material is more useful to reduce potential functional capability of collateral circulation of carcinoma or occlude small vessels. However this small and light particle tends to be reflux to the aorta and complications such as embolus in other organs may occur with powder passing through the A-V shunt. Experimental studies with transcatheter embolization of the renal artery showed that gelatin sponge pledgets stopped around the proximal portion of the renal artery while gelatin sponge powder was transmitted into smaller vessels following embolization. But two and four weeks after occlusion, recanalization extended throughout the major portion of the renal vasculature except for the peripheral cortical vessels. If enough gelatin sponge powder is employed to occlude up to the distal one third of the main renal artery, turbulence created by blood flowing into the artery may cause reflux of the gelatin sponge powder into the aorta. Thus, the use of powder is contraindicated because recanalization and reflux to the aorta can happen so easily<sup>1)</sup>. In transcatheter embolization, the state of embolus differs in each case because of the difference in catheter and embolic material, the amount and speed of pouring of embolic material and the blood circulation of the artery. Therefore, we need not consider gelatin sponge powder to be the only cause of neuropathy of the limb. Lieberman and others<sup>8)</sup>, however, applied transcatheter embolization with gelatin sponge powder to cases of upper gastrointestinal tract bleeding and reported that they observed gastric necrosis in two cases, and gastric ulceration in one. They also said that gelatin sponge powder should be used only to patients with coagulopathy or small vessels which cannot be embolized with gelatin fragments, because gelatin sponge powder can easily reach peripheral small vessels and thus tends to cause ischemic injury. In the genito-urinary tract, gelatin sponge powder should be applied only to patients such as those specified by Lieberman et al and in any case should not be used as first choice. Particularly in cases in which the patient can be operated on with the expectation of temporary arrest of hemorrhage and a decline in the amount of bleeding during operations, gelatin sponge pledgets are considered to be most suitable embolic material.

In order to reduce the possibility of complications, it is necessary to choose suitable embolic material and method of embolization. Especially for embolization of the internal iliac artery, we should limit the application to the anterior division of the internal iliac artery. We, therefore, reconsider this case and bear it in mind from now on.

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