

## Case Report

# Postoperative Systemic Dissemination of Injected Elemental Mercury

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There were only a few reports of mercury on pulmonary artery. However, there is no data on surgery related mercury dissemination. The objective of the present article is to describe one case of postoperative injected mercury dissemination. A 19-year-old man presented severe neck pain including meningeal irritation sign and abdominal pain after injection of mercury for the purpose of suicide. Radiologic study showed injected mercury in the neck involving high cervical epidural space and subcutaneous layer of abdomen. Partial hemilaminectomy and open mercury evacuation of spinal canal was performed. For the removal of abdominal subcutaneous mercury, C-arm guided needle aspiration was done. After surgery, radiologic study showed disseminated mercury in the lung, heart, skull base and low spinal canal. Neck pain and abdominal pain were improved after surgery. During 1 month after surgery, there was no symptom of mercury intoxication except increased mercury concentration of urine, blood and hair. We assumed the bone work during surgery might have caused mercury dissemination. Therefore, we recommend minimal invasive surgical technique for removal of injected mercury. If open exposures are needed, cautious surgical technique to prohibit mercury dissemination is necessary and normal barrier should be protected to prevent the migration of mercury.

**Key Words :** Bone work · Mercury poisoning · Postoperative complications · Transvascular dissemination.

## INTRODUCTION

There are many reports about mercury poisoning<sup>9)</sup>. Many people suffer from mercury poisoning in the industrial field, owing to environmental disasters, by accidents and even including suicidal trial. Various treatment options have been applied for the poisoned patients. However, surgical treatments are required in restricted state. Authors have experienced one case of injected mercury patients and report the complication after surgery with literature review. To our knowledge, it is the first report on surgery related vascular dissemination.

## CASE REPORT

A 19-year-old man in good previous health was transferred,

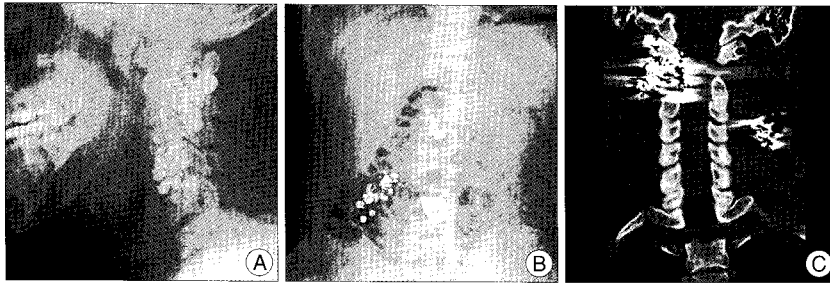
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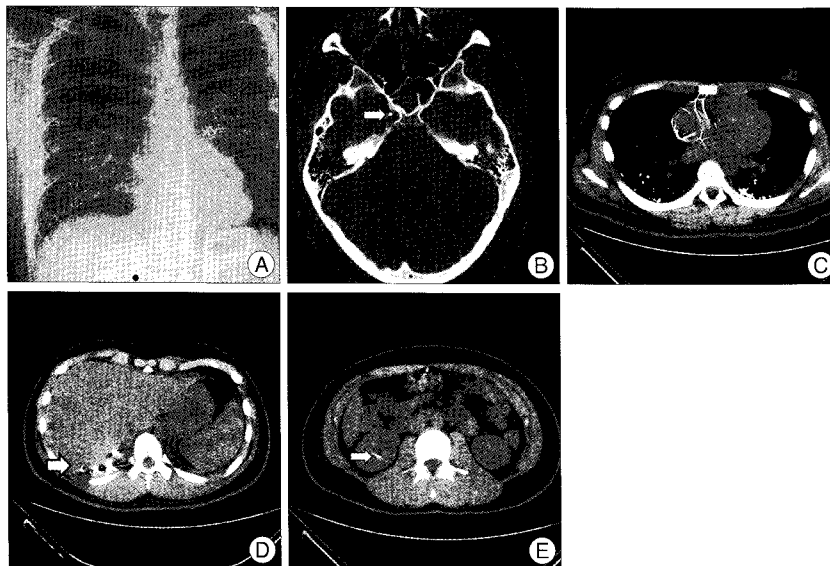
who had been clerk of hospital, suspected to be poisoned of harmful chemicals and injuring himself with elemental mercury injection. He had been treated with charcoal, moktin and penicillamine at the prior hospital. He complained of neck pain and abdominal pain. He was alert and there was no abnormal finding on neurologic examination except meningeal irritation sign. Redness and tenderness were observed at the neck and abdominal wall. Radiologic study showed radiopaque materials in the neck extended to the cervical epidural space and in the subcutaneous layer of the abdomen (Fig. 1).

## Operation findings

Under general anesthesia, prone position and C-arm fluoroscopic guided, midline skin incision and subperiosteal dissection to approach the right side of high cervical area was done. To avoid metal vaporization, cauterization was used cautiously. Exposed silver-colored liquid during dissection were evacuated. When right side C3 hemilaminectomy was done and ligament flavum removed, the silver-colored liquid gushed out from the spinal canal. Exposed cervical dura was thickened owing to inflammations around the dura. In the operation field, all silver-like materials were removed. Drain catheter was inserted and operation wound was closed. On the left side of the neck, because of the muscular bleeding, C-arm fluoroscopy guided nee-



**Fig. 1.** Preoperative radiologic findings. A : Cervical spine X-ray demonstrating radiopaque material on C1-2-3-4 level. B : Abdominal AP view showing radiopaque material on the middle abdomen, C : 3 dimensional reconstruction view of cervical computed tomography (CT) demonstrating C1-2-3 area radiopaque material in the spinal canal.



**Fig. 2.** Postoperative radiologic findings. A : Chest X-ray demonstrating multiple radiopaque materials including increased pulmonary vascular markings. B : Brain CT showing metal droplet on right paracalcineal area. C, D and E : Chest and abdomino-pelvic noncontrast CT view demonstrating radiopaque droplets at pulmonary vessel, coronary vessel, hepatic vessel, kidney parenchyma, low spinal canal, intermuscular space, and to other various parts of the body.

dle aspiration was done. The day after operation, about 15 cc of liquid which was a mixture of chocolate-color blood and silver-color liquid was aspirated under C-arm fluoroscope on the abdominal area.

### Postoperative finding

Although there were some residual radiopaque materials after operation, neck pain including meningeal irritation sign and abdominal pain were improved. However, there were evidences of disseminated radiopaque material on radiologic study without any clinical signification. Radiopaque material was observed in the skull base, anterior epidural space, coronary arteries, pulmonary vessel, muscle layer, epidural space of low lumbar, and to other various parts of the body (Fig. 2). Postoperatively, except for temporary fever, no respiratory, gastrointestinal, renal, neuronal and dermal problems were detected. In laboratory findings after 30 days mercury injection, urinary daily mercury excretion was 1,123.3 µg/day, blood mercury concentration was 374.2 µg/L

and mercury on hair was 2.3 µg/g, respectively. After 50 days of follow-up, there were no signs of significant findings of elemental mercury intoxication.

### DISCUSSION

In its elemental form, the melting point of mercury is -38.8°C and mercury is the only metal that exists in a liquid state at room temperature. There are many literatures about mercury poisoning. The toxicological manifestations of mercury have been reported a thousand years ago. In recent centuries, mercury preparations have been widely used as therapeutics, such as in ointment for dermatitis, diuretics, cathartics, and anti-fungals<sup>2</sup>. Nowadays, contemporary controversies involving mercury include the potential for toxicity from mercury-containing dental amalgams, fish and mercury-based preservatives (thimerosal) in childhood immunizations<sup>12</sup>.

Exposure to metallic mercury may occur through either inhalation, oral, or dermal routes, depending on the specific type of mercury<sup>11</sup>. People have sometimes used mercury to injure themselves. Among the various method of self-injury with mercury, there were some reports of injection, intravenously or intramuscularly. In these cases, surgical removal should be done<sup>6</sup>.

According to Bradberry, injection of elemental mercury is rare and only 72 cases have been reported in the literature over the period between 1923 and 1995<sup>3</sup>. Among these, there were only a few reports of mercury on pulmonary artery like our case<sup>7,9</sup>.

However, this is the first report of pulmonary artery dissemination of mercury after surgical treatment. Before surgical treatment, mercury was limited at intramuscular space. After surgery, mercury spread out along the spinal canal and along the venous structure to the pulmonary artery. There have been many reported cases of air embolism during operation<sup>4,8,10,14,15</sup>. We assumed that not only air or gas but mercury as well could be transported by vessel, if it is contacted with exposed cancellous bone during bone works.

In some reports, following metallic mercury injection, features of systemic mercury poisoning usually occur only when mercury enters the bloodstream or lymphatics<sup>3,5,13,16</sup>. However, some authors have reported that no symptomatic presentation of intravascular elementary mercury deposit on the pulmonary

vessel, even though there are elevated blood concentration of mercury and increased urinary excretion<sup>17)</sup>. In this report, elemental mercury was injected and there were no significant systemic findings in spite of a short follow-up period.

## CONCLUSION

We report one case of surgery related transvascular elemental mercury dissemination. We assumed the bone work during surgery might have caused it and recommend minimal invasive surgical technique for removal of injected mercury. If open exposures are needed, cautious surgical technique to prohibit mercury dissemination is necessary and normal barrier should be protected to prevent the migration of mercury. We hope this report to be some kind of assistance to those surgeons who need to perform surgical mercury removal.

## References

1. Ambre JJ, Welsh MJ, Svare CW : Intravenous elemental mercury injection : blood levels and excretion of mercury. *Ann Intern Med* 87 : 451-453, 1977
2. Asano S, Eto K, Kurisaki E, Gunji H, Hiraiwa K, Sato M, et al. : Review article : acute inorganic mercury vapor inhalation poisoning. *Pathol Int* 50 : 169-174, 2000
3. Bradberry SM, Feldman MA, Braithwaite RA, Shortland-Webb W, Vale JA : Elemental mercury-induced skin granuloma : a case report and review of the literature. *J Toxicol Clin Toxicol* 34 : 209-216, 1996
4. Cobb WS, Fleishman HA, Kercher KW, Matthews BD, Heniford BT : Gas embolism during laparoscopic cholecystectomy. *J Laparoendosc Ad Surg Tech A* 15 : 387-390, 2005
5. Fichte B, Ritzau F, Assmann H : [Metallic mercury poisoning. Case report.] *Radiologe* 24 : 95-97, 1984
6. Graeme KA, Pollack CV Jr : Heavy metal toxicity, part I : arsenic and mercury. *J Emerg Med* 16 : 45-56, 1998
7. Gutiérrez F, Leon L : Images in clinical medicine. Elemental mercury embolism to the lung. *N Engl J Med* 342 : 1791, 2000
8. Kim CS, Liu J, Kwon JY, Shin SK, Kim KJ : Venous air embolism during surgery, especially cesarean delivery. *J Korean Med Sci* 23 : 753-761, 2008
9. McFee RB, Caraccio TR : Intravenous mercury injection and ingestion : clinical manifestations and management. *J Toxicol Clin Toxicol* 39 : 733-738, 2001
10. Ohnishi H : [Side effects of phlebotomy : pathophysiology, diagnosis, treatment and prophylaxis.] *Rinsho Byori* 53 : 904-910, 2005
11. Risher JF, Amler SN : Mercury exposure : evaluation and intervention the inappropriate use of chelating agents in the diagnosis and treatment of putative mercury poisoning. *Neurotoxicology* 26 : 691-699, 2005
12. Sue YJ : Mercury in : Goldfrank LR(ed) : *Goldfrank's toxicologic emergencies*, ed 7. New York : McGraw-Hill, 2002, pp1239-1248
13. Tanner DC, Branch M, Schreiner RD, Morgan HJ : Subcutaneous deposition of elemental mercury. *J Tenn Med Assoc* 81 : 698-699, 1988
14. Wills J, Schwend RM, Paterson A, Albin MS : Intraoperative visible bubbling of air may be the first sign of venous air embolism during posterior surgery for scoliosis. *Spine* 30 : E629-E635, 2005
15. Yoon SH, Cho KH, Kim SH, Ahn YH, Ahn YM, Cho KG, et al. : A case of pulmonary air embolism during endoscopic third ventriculostomy - a case report - *J Korean Neurosurg Soc* 26 : 283-286, 1997
16. Zillmer EA, Lucci KA, Barth JT, Peake TH, Spyker DA : Neurobehavioral sequelae of subcutaneous injection with metallic mercury. *J Toxicol Clin Toxicol* 24 : 91-110, 1986