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CO_2 Contrast as Alternative Media Contrast for Renal Insufficiency Patient in Angiography: An Evidence Based Case Report

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Abstract

The use of iodine contrast, which is more commonly used, is associated with systemic effects in nephrogenic systemic fibrosis, contrast-induced nephropathy (CIN) in patients with kidney function disorders, geriatric, hypertension, and patients with comorbid diabetes mellitus and hypersensitivity reactions. An evidence-based case report was carried out in the Medical Department of Surgery, FKUI-RSCM. The study indicated that the safety of CO_2 angiography did not cause CIN to manifest and showing CO_2 contrast proved to be safe for patients who have impaired renal function.

Key words: CO_2 contrast, angiography, contrast-induced nephropathy

Introduction

The use of CO_2 contrast in angiography has been known since 1950. However, In the 1970s, intraarterial CO_2 contrast was reported with a sustained progress in the development of digital subtraction angiography (DSA) that gave good results as a supporting tool for endovascular procedures. Meanwhile, the use of iodine contrast, which is more commonly used, is associated with systemic effects in nephrogenic systemic fibrosis, contrast-induced nephropathy in patients with renal dysfunction, geriatric, hypertension, and patients with comorbid diabetes mellitus and hypersensitivity. For this reason, it is necessary to find a level of evidence supporting studies and literature that supports the use of CO_2 as a contrast agent in a multi comorbid patient with a display quality that is not significantly different from iodine contrast in patients undergoing angiography procedures.

Case illustration

A 73-year-old man came to the ER with a chief complaint of intermittent abdominal pain for three days. The pain felt pulsated, did not radiate, and presented inconsistently for the last two months, but no changes in bowel habits. The patient once came to dr. Cipto Mangunkusumo Hospital Emergency Room (ER) in the previous two months with constipation and a colic abdominal pain, and the diagnostic examination show an obstruction on the bowel. Afterward, the patient underwent explorative laparotomy. Intraoperatively mild adhesion of the bowel was found, which was released. Another critical finding was pulsating abdominal aorta. Computed Topography Angiography (CTA) was done and shows an abdominal infrarenal aorta aneurysm about 41 mm from the left renal artery to aorta bifurcation with a diameter of 47 mm, then the patient was scheduled for Endovascular Aneurysm Repair (EVAR). On further history taking, we found hypertension for a year. The hemodynamic was stable with blood pressure was 120/70 mmHg, heart rate was 88 bpm, and oxygen saturation was 99%. The abdomen was flat with a normal bowel movement. There was no tenderness and no palpable mass, but we found a pulsatile area in the supraumbilical. Before surgery, the haemoglobin content was 10g/dL, urea 45.8 mg/dL, creatinine serum was 2.23 mg/dL. Blood gas analysis denoting pH 7.5, pCO_2 31.8 mmHg, pO_2 262.2mmHg, base excess 3.9 mmol/L, HCO_3 -25.8 mmol/L.

Angiography with CO_2 contrast using a CO2 injector with bilateral femoral access has been inserted beforehand. We did diagnostic tests with CO2 with the volume of 100 ml and a 700 mmHg pressure. Radiographic imaging with DSA 3-6 frames per second post CO2 injection. After EVAR, the blood pressure was 110/70, the heart rate was 70 bpm, and the saturation was 99%. The abdomen was flat, normal bowel movement, tympanic on percussion, no hematoma on the puncture site. VAS score of 1-2, no vomiting. The hemoglobin content 10.8 g/dL, pCO2 34.5 mmHg, pO2 258.1 mmHg, base excess 3.2 mmol/L, HCO 3 -25.9 mmol/L. The urea 28 mg/dL and creatinine serum 1.6 mg/dL.

We proceed a literature search to answer the clinical questions, namely a level of evidence of the procedure. The keywords used were "renal insufficiency" or "kidney failure" AND "angiography CO2" OR "CO2 angiography" AND "iodine contrast" OR "iodinated contrast" AND "contrast-induced nephropathy" OR "CIN" in some databases, i.e., Cochrane Library, PubMed and ScienceDirect. Three articles supported our case reports, a prospective study, and two retrospective cohort studies with a level of evidence 3. me databases, i.e., Cochrane Library, PubMed and ScienceDirect. Three articles supported our case reports, a prospective study, and two retrospective cohort studies with a level of evidence 3. The studies indicated the safety of the use of CO2 angiography, and no one manifested to contrast-induced nephropathy.

Discussion

We found three articles to support our case on literature search and discussed CO_2 contrast as an alternative for patients with renal impairment. Fujihara et al. have done the angiography and angioplasty

for the iliofemoral abnormality using CO_2 contrast and a combination, if necessary, with a minimal dose. The incidence of contrast-induced nephropathy was approximately 5.1% of all cases.

Spinosa et al. reported that an increased creatinine serum incidence was higher when CO_2 is combined with Gadodiamide compared with noniodine contrast. Zero incidences of contrast-induced nephropathy were found with the use of CO_2 alone. Scalise et al. comparing the visibility of 40 patients with CO_2 compared with iodine iodixanol showed no significant difference. Approximately 94 to 98 percent have reported no incidence of contrast-induced nephropathy. Chao's study enrolling 100 patients who underwent EVAR found that creatinine serum was normal in half of their samples. The group with increased creatinine serum was those given CO_2 contrast.

In the 30 days follow-up, they reported no incidence of contrast-induced nephropathy in the two groups (those given CO_2 contrast and those not); but they found the difference regarding endoleak. In the group, which was given CO_2 contrast, 18% of them occurred but not statistically significant. Radiation dose is not increased to the patient who treated using CO_2.

Conclusion

The use of CO_2 contrast is safe for patients with impaired renal function. The incidence of contrast-induced nephropathy was considered minimal and, in some studies, was not found.

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