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ORIGINAL RESEARCH

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# Is Fasting Necessary for Elective Cerebral Angiography?

**BACKGROUND AND PURPOSE:** In order to prevent unexpected events such as aspiration pneumonia, cerebral angiography has been performed under fasting in most cases. We investigated prospectively the necessity of fasting before elective cerebral angiography.

**MATERIALS AND METHODS:** The study is an open-labeled clinical trial without random allocation. In total, 2554 patients who underwent elective cerebral angiography were evaluated on development of nausea, vomiting, and pulmonary aspiration during and after angiography. Potential risks and benefits associated with fasting were provided in written documents and through personal counseling to patients before the procedure. The patients chose their fasting or nonfasting option. No restriction in diet was given after angiography. The patients were observed for 24 hours. Nausea and vomiting during and within 1 hour after angiography was considered as a positive event associated with cerebral angiography.

**RESULTS:** The overall incidence of nausea and vomiting during and within 1 hour after angiography was 1.05% (27/2554 patients). There was no patient with pulmonary aspiration. No statistical difference in nausea and vomiting development between the fasting and the diet groups was found.

**CONCLUSIONS:** The incidence of nausea and vomiting associated with cerebral angiography is low and not affected by diet or fasting. Pulmonary aspiration had no difference between the diet and the fasting group. Our study suggests that fasting may not be necessary for patients who undergo elective cerebral angiography.

**ABBREVIATIONS:** NPO = nothing by mouth

Preoperative fasting was first introduced in labor wards in the 1940s to reduce the incidence and severity of pulmonary aspiration. Now, it has become a routine preparatory step for many procedures that require general anesthesia.[1,2] Protective reflexes such as gag and swallowing are reduced with general anesthesia. Unconsciousness associated with general anesthesia also eliminates these protective responses. Recent evidence has demonstrated that traditional prolonged fasting is no longer valid, even for general anesthesia. Fasting does not make the stomach empty.[3] Preoperative intake 2 hours before surgery does not increase the risk of pulmonary aspiration.[4,5] Above all, pulmonary aspiration is a very rare event.[6,7] However, preoperative fasting has been a routine preparative step in most cases for cerebral angiography, despite local anesthesia.

As background, we retrospectively reviewed 926 consecutive patients who underwent elective cerebral angiography with traditional fasting in our hospital from January 2004 to August 2005. Periprocedural vomiting occurred in 0.4% of these patients. A brief pause in the procedure and simple head turning were enough to manage vomiting. There was no pulmonary aspiration case. Based on our experience, we established a new fasting protocol for elective cerebral angiography. The new protocol includes no fasting before angiography for elective patients. We performed a nonrandomized comparative clinical trial to find whether the occurrence of nausea, vomiting, and pulmonary aspiration is different between nonfasting and fasting groups undergoing elective cerebral angiography.

## Materials and Methods

The study protocol was approved by the local institutional review board. Informed consent was obtained from all patients scheduled for elective cerebral angiography. Outcomes by the protocol were reported to the local department board and reviewed regularly.

We designed an open-labeled clinical trial without random allocation and blinding. From September 2005 to March 2009, 4912 patients in total underwent elective cerebral angiography. We excluded the patients ($n = 2358$) with endovascular intervention, nonelective emergent angiography, and angiography under general anesthesia. We also excluded patients with tube feeding or swallowing difficulty, those with current symptoms of vertigo or uncontrolled seizure, pediatric patients younger than 15 years, and pregnant patients. In total, 2554 patients were enrolled in this study.

Potential risks and benefits of fasting and nonfasting were explained by written documents and personal counseling. Patients were supposed to select their fasting or nonfasting option. The fasting group did not eat anything for a minimum of 6 hours before the angiography. The diet group (nonfasting) was instructed to have their normal diet as usual. Neither restricting nor encouraging food intake was recommended. All patients were allowed to take any food after angiography. Angiography schedule was determined on a first-come,

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**Relationship between NPO status before angiography and vomiting**

| | Before Matching | | | After Propensity Score Matching | | |
|---|---|---|---|---|---|---|
| | Diet Group ($n$ = 2354) | Fasting Group ($n$ = 200) | Odds Ratio | Diet Group ($n$ = 1800) | Fasting Group ($n$ = 200) | Odds Ratio |
| Nausea/vomiting + | 22 (0.9) | 5 (2.5) | 0.35 (0.13–0.95) | 20 (1.1) | 5 (2.5) | 0.49 (0.17–1.40) |
| Nausea/vomiting − | 2332 (99.1) | 195 (97.5) | | 1780 (98.9) | 195 (97.5) | |

**Note:**—Values in parentheses are percentages.

first-served basis. No preparation except mild intravenous hydration with normal saline was given before angiography.

All cerebral angiography was performed by using a biplane angiomachine (Integris Allura; Phillips Medical Systems, Best, the Netherlands) through the transfemoral route in a conventional manner. No sedation or pain medication was given. Omnipaque 300 (GE Healthcare, Piscataway, New Jersey) was used as contrast. If vomiting or nausea occurred, the procedure was stopped immediately, the patient's head was turned, and the procedure was reinitiated once the patient was stabilized. Manual compression at the puncture site for 10–15 minutes was performed at the completion of angiography.

We collected various information, including age; body weight; height; focal neurologic deficits; presence of posterior fossa lesion, which could be a risk factor of vomiting and seizure; and combined medical conditions, such as diabetes and hypertension. A history of gastrointestinal diseases was recorded, including gastritis ulcers, dyspepsia, polyps, cancer, liver disease, and gallstones. All pre-existing allergies, including to food and drugs, and contrast were recorded. Any vomiting or nausea was recorded for 24 hours. We diagnosed aspiration pneumonia mainly by clinical signs, symptoms, and chest radiograph.

Per-protocol analysis between the diet and fasting groups on fasting duration criteria of 6 hours was planned. The basic characteristics between the fasting and the diet groups were compared by Student $t$ test for continuous variables and Pearson $\chi^2$ test for the categoric variables. To avoid selection and information bias, we conducted propensity score matching. The propensity score, defined as the conditional probability of being treated given the covariates, can be used to balance the covariates and increase the comparability between fasting and nonfasting groups. The difference was tested by relative risk and its 95% confidence interval in multivariate unconditional logistic analysis.

## Results

The basic characteristics of the patients were summarized in the On-line Table. Diseases requiring cerebral angiography were ischemic stroke (44.6%), cerebral aneurysm (35.9%), brain tumor (8.1%), vascular malformation (4.2%), intracranial hemorrhage (4.1%), and others (3.1%). Gastrointestinal diseases were reported in 2.4% and allergies in 8.4% of the patients. Focal neurologic deficits were noted in 974 (38.1%) patients and included dysphasia, diplopia, and hemiparesis. Fifty-three (2.1%) patients had controlled seizure. In total, 2354 patients (diet group) ate something before angiography. The average time for taking food in the diet group was 1.84 ± 1.0 hours (range, 0–6 hours) before angiography. Most patients ingested rice meals (92.4%). Other meals were as follows: blend diet with or without vegetables (1.7%), soft foods such as noodles, breads (1.1%), fruit, or noncooked vegetables (0.4%); soft fluid diet or drinks (4.3%); and other meals, including alcohol (0.1%).

The overall incidence of nausea (8 cases) and vomiting (19 cases) was 1.05% (27/2554 patients); there were 11 vomiting cases and 3 nausea cases during angiography (0.55%, 14/2554) and 8 vomiting and 5 nausea cases within 1 hour after angiography (0.51%, 13/2554).

Nausea and vomiting developed in 1.0% of the diet group and in 2.5% of the fasting group (Table). But, the incidence of nausea/vomiting was not statistically different between the fasting and the diet groups. There was no case of pulmonary aspiration in either group.

Major procedural adverse events occurred in 8 patients (0.31%), including 3 thromboembolisms that were managed by direct intra-arterial thrombolysis, resulting in no deficit in 2 and permanent deficit in 1 patient; 1 carotid artery and 1 vertebral artery dissection, which were treated with stent placement; and 3 hemostasis failures, which were treated by local thrombin injection and prolonged sono-guided compression. There was no adverse event that required conversion to emergent surgical rescue under general anesthesia.

## Discussion

In general anesthesia, considerable new evidence has shifted the paradigm of preoperative fasting as a preventive role for pulmonary aspiration. First, it turns out that an empty stomach cannot be achieved by fasting. Fasting decreases neither gastric volume nor gastric acidity.[3] Preoperative intake 2 hours before surgery did not increase the risk of pulmonary aspiration.[4,5] Second, pulmonary aspiration is a rare event, and its fatality is believed to be low.[6] A review of 185,358 surgical procedures under general anesthesia in Sweden revealed only 5 cases of aspiration pneumonitis; all were nonfatal.[7] In a similar retrospective review of 215,488 surgical procedures under general anesthesia, pulmonary aspiration occurred at an incidence of 1 in 3886 patients. The incidence in healthy patients was far lower—1 in 8000. None of the aspiration resulted in serious outcomes or death.[8] Now, the consensus is that clear fluids are allowed up to 2 hours and light meals up to 6 hours before general anesthesia.

Cerebral angiography could be performed under local anesthesia in most cases. No muscle relaxation-paralysis and unconsciousness is induced. There is no induction-intubation and extubation-recovery process, the riskiest steps for gastric regurgitation.[9,10] Nausea and vomiting after the operation could occur, but are also issues associated with general anesthesia.[9,11] Moreover, vomiting does not necessarily mean pulmonary aspiration. In conscious and cooperative patients, it can be avoided simply by head turning, spewing, or swallowing.

One may advocate that cerebral angiography could produce complications that might require conversion to emergent surgery under general anesthesia. But elective cerebral

angiography is a benign diagnostic procedure. The complication rate is very low.[12] Most adverse events do not require emergent surgical rescue to solve.

The nature and causes of the nausea and vomiting associated with cerebral angiography have not been clearly defined. Considering various timing of nausea and vomiting development during and after cerebral angiography, we think that complex etiologies affect contrast and psycho-emotional, vasovagal, or unknown reactions. The purpose of fasting is to reduce pulmonary aspiration of gastric regurgitation. A prerequisite of aspiration—nausea, vomiting, or both—is rarely associated with cerebral angiography. Of note, our observation revealed that significant nausea and vomiting occurred 2.5 times more in the traditional fasting group than the diet group, though it did not reach a statistical significance. Our study suggests that fasting would not be an essential preparatory step for many patients who undergo elective cerebral angiography.

This is a nonrandomized, nonblinded, open-labeled study. It could have bias in patient selection. In our study, most patients ate rice food. The rice food consisted of steamed rice, soup, vegetables, and small amounts of meat or fish. Results of this study may not be applied to people in other meal cultures.[13,14] The amount of undigested foods was not checked. It could potentially affect the incidence of nausea and vomiting. Most food was provided by the hospital, so individual variation may not be high.

In this article, we considered nausea and vomiting during the procedure and within 1 hour after the procedure as a positive event associated with cerebral angiography. If we expand the time, for example, to 24 hours, the incidence of nausea and vomiting might be higher. But we think that 1 hour is an acceptable time that could be influenced by the angiographic procedure because food intake was not restricted after angiography. Of note, only 6 patients (3 in the diet group, 3 in the fasting group) had nausea, vomiting, or both between 1 and 6 hours after angiography. So, this number does not influence our statistical results.

## Conclusions

Pulmonary aspiration did not occur in 2554 patients with elective cerebral angiography. The incidence of nausea and vomiting associated with cerebral angiography was very low and was not affected by diet or fasting. Our study suggests that fasting would not be an essential preparatory step for many patients who undergo elective cerebral angiography.


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