

# Fasting and cardiac catheterisation – should we be following the evidence?

## Key words:

Angiography; angioplasty; heart catheterisation; fasting; anaesthesia

## James Rosengarten, Muhiddin Ozkor, Charles Knight

Department of Cardiology, Barts and The London NHS Trust, London, UK

## Address for correspondence:

Dr Charles Knight  
Department of Cardiology,  
London Chest Hospital,  
Bonner Road, London E2 9JX, UK  
Tel: +44-(0)20-8983-2248 Fax: +44-(0)20-8983-2278  
Email: charles.knight@bartsandthelondon.nhs.uk

## Abstract

It is usual for food and fluids to be withheld for variable periods before cardiac catheterisation. Fasting is considered necessary to reduce the risk of aspiration in the case of emergency surgery or cardiac arrest. The risks involved are low compared with the greater risk of complications associated with dehydration, hypoglycaemia and omission of medication. Existing guidelines do not give clear direction and are not evidence based. We propose a less stringent approach with unlimited clear fluids allowed until the time of the procedure.

## Introduction

Cardiac catheterisation can be a worrying experience for a patient and the typical requirement to fast for a variable period of time may increase the stress. Patients often err on the side of caution and may arrive at the hospital having fasted from midnight and failed to take antihypertensive medication, in case this constitutes food.<sup>1</sup> By the time the patient reaches the catheterisation laboratory, it may be 12 hours since they last ate and perhaps 6 hours without any fluid intake other than sips of water at best. Consequently, the patient is likely to be dehydrated and possibly hypoglycaemic. This may make arterial access more difficult and increase the risk of contrast-induced nephropathy (volume depletion is an important predictor of CIN); in addition, uncontrolled hypertension may lead to problems in removing the sheath.

We feel that there is little evidence to support the current system and that a more radical approach should be taken.

## Historical perspective

Cardiac centres across the UK perform a variety of diagnostic and interventional procedures every day, and each hospital has a policy relating to pre-procedure fasting for food and fluids. A period of fasting is considered necessary before cardiac catheterisation to minimise the volume of gastric contents in case of emergency transfer for intubation and surgery or unexpected cardiac arrest. It has been traditional in the UK that surgical patients are 'nil by mouth from midnight', and to some extent this surgical policy has been adopted by cardiac laboratories.

Clinically significant pulmonary aspiration during general anaesthesia is rare in healthy patients undergoing surgery. In the largest study of over 200,000 anaesthetic procedures, aspiration occurred in approximately one

in 4,000 elective cases, increasing to one in 900 for emergency procedures. Death from respiratory failure occurred in three patients.<sup>2</sup>

Historically, anaesthetic guidelines have differed. Although the earliest books on anaesthesia did not mention fasting, Lister recommended in 1883 that there should be no solid matter in the stomach, although patients should drink clear liquid until about 2 hours before surgery.<sup>3</sup> Most textbooks recommend a 6-hour fast for solids and 2–3 hours for clear liquids. During the 1960s, early studies in gastric physiology led to the preoperative order 'nil by mouth after midnight', applying to both solids and liquids.

In 1974, Roberts and Shirley suggested that the presence of 0.4 ml/kg (25 ml in adults) of gastric contents with pH <2.5 was associated with a high risk of pulmonary aspiration. However, there was no relationship between the volume in the stomach and the volume aspirated into the lungs. The authors later revealed that they had drawn their conclusion after instilling 0.4 ml/kg acid into the right mainstem bronchus in only one experiment in a single monkey.<sup>4</sup>

Modern physiological studies use a dual isotope technique in which solids and liquids are tagged with different radioactive isotopes. Figure 1 demonstrates the exponential gastric emptying of clear liquids: 90% empty within 1 and virtually all within 2 hours. Such liquids do not contain particles >2 mm and therefore pass immediately through the pylorus.<sup>5,6</sup>

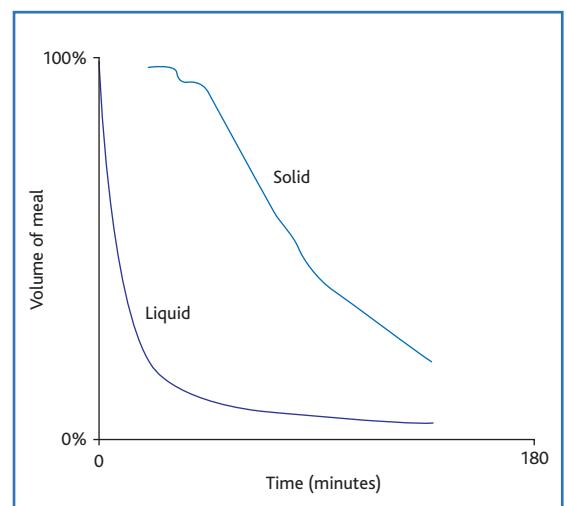
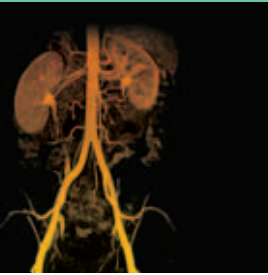


Figure 1. Gastric emptying varies with meal type.



**Dr Charles Knight** trained at Cambridge and Oxford Universities and is currently a consultant cardiologist at the London Chest Hospital. Dr Knight has a particular interest in chest pain, acute coronary syndromes and hypertrophic cardiomyopathy. He specialises in coronary angioplasty and stenting and has considerable experience in interventional cardiology and in the renal complications of coronary artery disease and its treatment. Dr Knight is Head of Cardiology at Barts and the London NHS trust. He is Honorary Secretary Elect of the British Cardiovascular Society and serves as a specialist advisor to NICE.

# Fasting and cardiac catheterisation – should we be following the evidence? *continued*

James Rosengarten, Muhiddin Ozkor, Charles Knight

'Clear liquids' include water, apple juice, carbonated beverages, clear tea and black coffee. Sugar and up to 10 ml (two teaspoons) of milk may be added to tea or coffee. If any more milk is added, the effects of gastric juice lead to the formation of a thick flocculate that is treated as a solid and may remain in the stomach for up to 5 hours. The pylorus prevents passage of particles >2 mm, so digestible solids (bread, meat, boiled potatoes) must be broken down to particles <2 mm before they can pass into the small bowel. Total emptying of the contents of the stomach after a meal normally takes 3–5 hours. Large particles of indigestible food, especially cellulose-containing vegetables, empty by a different mechanism, taking 6–12 hours after the stomach has emptied liquid and digestible food.<sup>5,6</sup>

In 1983, Miller *et al.* reported no difference in gastric fluid volume or pH between patients who received 'nil by mouth after midnight' and those who had tea and toast 2–4 hours before surgery.<sup>7</sup>

A Cochrane review of 38 randomised controlled comparisons revealed there was no evidence to suggest that a shorter fluid fast results in an increased risk of aspiration, regurgitation or related morbidity compared with the standard 'nil by mouth from midnight' fasting policy. In fact, permitting patients to drink water preoperatively resulted in significantly lower gastric volumes.<sup>8</sup>

### Current practices

#### International

There is no mention of fasting before cardiac procedures in either the latest joint American Heart Association/ American College of Cardiology or the European Society of Cardiology guidelines.<sup>9,10</sup>

#### UK

Current British Cardiovascular Intervention Society guidelines do not mention pre-procedural fasting.<sup>11</sup> A telephone survey of UK angioplasty centres indicated that all were aware of local fasting policies but that these were not clearly evidence based. Results varied, and Figure 2 highlights the heterogeneity.

*Diagnostic angiography:* With regard to food, 10% of centres asked patients to fast for 1–4 hours, 59% for 4–6 hours, 12% for 6–8 hours and a further 12% for 8 or more hours; 6% did not require a food fast. For fluids, 49% withheld fluids for 1–4 hours, 33% for 4–6 hours, 6% for 6–8 hours and 8% for 8 hours or more; 12% required no fluid fast before diagnostic procedures. The median duration of fasting before angiography was 4 hours for food and 2 hours for fluids.

*Percutaneous intervention:* With regard to food, 10% asked patients to fast for 1–4 hours, 60% for 4–6 hours, 12% for 6–8 hours, 14% for 8 hours or more and 4% required no food fast. For fluids, 41% withheld fluids for 1–4 hours, 31% for 4–6 hours, 6% for 6–8 hours, 8% for 8 hours or more and 10% required no fluid fast before percutaneous intervention. The median duration of fasting before angioplasty was 4 hours for food and 3 hours for fluids.

Two centres had a 'no fasting' policy for either procedure. One was able to cite (unpublished) audit data suggesting that few cases needed emergency transfer to theatre and that the time for transfer was over 2 hours. The other centre had changed its policy recently but did not have data to support the change, identifying problems of dehydration and the apparent rarity of surgery as driving forces. One other centre did not require fasting before

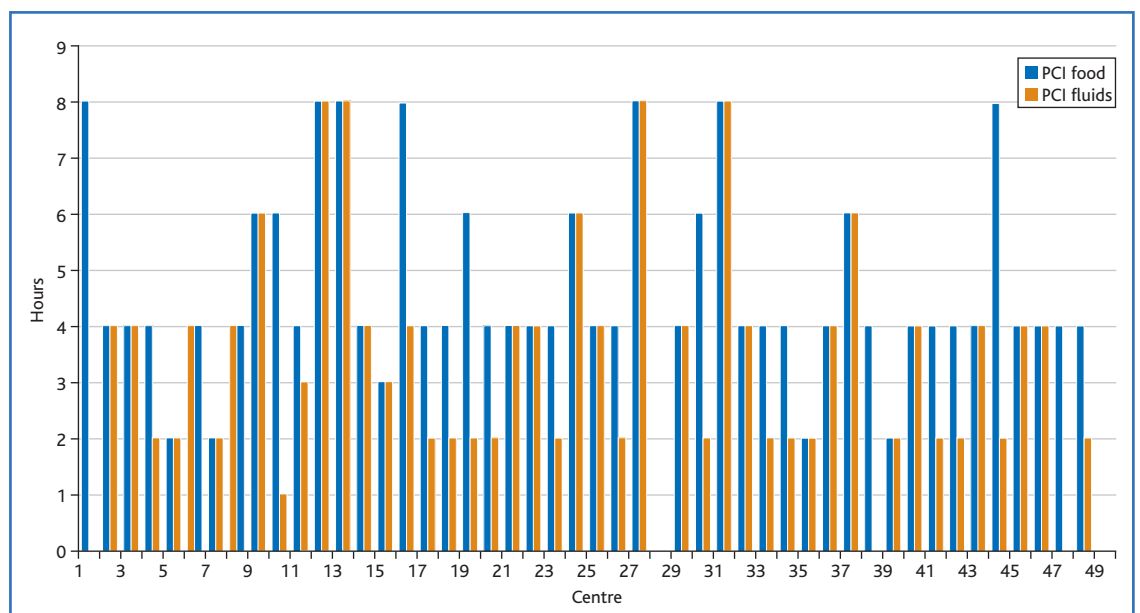
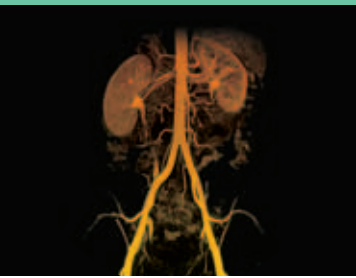


Figure 2. Fasting times for coronary intervention varied widely between centres.

diagnostic angiography but withheld food for 4 hours and fluids for 2 hours before percutaneous intervention.

In addition, no relationship was seen between duration of fasting and availability of cardiothoracic surgical facilities or estimated time for transfer to emergency surgery. Nor was there a relationship between duration of fasting and the patient's place on the angiography list.

#### Aspiration and complications of cardiac catheterisation

Concerns relating to fasting become relevant in situations when aspiration may occur. Recent data suggest that emergency coronary artery bypass surgery following complicated cardiac catheterisation is required in between 0.15% and 0.4% of cases.<sup>12,13</sup> The incidence of cardiac arrest is less well documented but appears to be under 1%.<sup>14</sup>

In the cases of the ~1% of patients who experience cardiac arrest or need emergency surgery, it is reassuring to know that only approximately 4% of all emergency (and therefore non-fasted) intubations outside of the operating room show evidence of infiltrates suggestive of pulmonary aspiration on chest radiography. In addition,

only 0.11% demonstrate clinical aspiration requiring respiratory support.<sup>2,15</sup>

Therefore, the cumulative risk of complications of aspiration associated with emergency surgery or DC cardioversion in a non-fasted patient undergoing cardiac catheterisation is in the order of 0.0015%, equivalent to one case in 70,000. This is well below the 1:1000 risk typically quoted for myocardial infarction, stroke or death in diagnostic angiography and the 1:100 risk in percutaneous coronary intervention, and indeed below the 14% risk of contrast-induced nephropathy.<sup>16</sup>

#### Conclusion

We propose a less stringent approach to pre-procedure fasting, according to which patients are not required to fast before arriving at the cardiac unit and can drink water, fruit juice and sweet, strong tea and coffee up to the time of angiography. This would not only simplify the preadmission procedure but also reduce the serious complication of contrast-induced nephropathy, since volume depletion is an important risk factor for this condition. Practical issues surrounding medication, hypertension, hypoglycaemia and associated complications would also be reduced.

### Key Learning

- There is little evidence to support the current practice of withholding food and fluids for a variable period before cardiac catheterisation
- Current US, European and UK guidelines do not specify pre-procedural fasting
- A telephone survey of UK centres showed that they have a fasting policy, but the duration varies widely
- The evidence suggests that the cumulative risk of complications of gastric aspiration is very low in a non-fasted patient undergoing cardiac catheterization who needs emergency surgery or cardioversion
- A more relaxed policy is proposed according to which patients are allowed to eat until they arrive at the unit and to drink clear fluids up to the time of the procedure

### References

1. Best C, et al. How 'nil by mouth' instructions impact on patient behaviour. *Nurs Times* 2004;**100**:32–4.
2. Warner MA, et al. Clinical significance of pulmonary aspiration during the perioperative period. *Anesthesiology* 1993;**78**:56–62.
3. Lister J. On anaesthetics. In: *The collected papers of Joseph, Baron Lister, Vol 1*. Oxford: Claridon Press, 1909:172.
4. Roberts RB, et al. Reducing the risk of gastric aspiration during Cesarean section. *Anesth Analg* 1974;**53**:859–68.
5. Minani H, et al. The physiology and pathophysiology of gastric emptying in humans. *Gastroenterology* 1984;**86**:1592–610.
6. Collins PJ, et al. Gastric emptying in normal subjects – a reproducible technique using a single scintillation camera and computer system. *Gut* 1983;**24**:1117–25.
7. Miller M, et al. Gastric contents at induction of anaesthesia. Is a 4-hour fast necessary? *Br J Anaesth* 1983;**55**:1185–8.
8. Brady M, et al. Preoperative fasting for adults to prevent perioperative complications. Cochrane Database of Systematic Reviews. Art. No.: CD004423. DOI: 10.1002/14652858. CD004423.
9. ACC/AHA Guidelines for Percutaneous Coronary Intervention (revision of the 1993 PTCA Guidelines). *J Am Coll Cardiol* 2001;**37**:2239i–lxvi.
10. Dieker HJ, et al. ESC guidelines for percutaneous coronary interventions. *Eur Heart J* 2005;**26**:804–47.
11. Dawkins KD, et al. Percutaneous coronary intervention: recommendations for good practice and training. *Heart* 2005;**91**(Suppl 6):vi1–27.
12. Williams DO, et al. Percutaneous coronary intervention in the current era compared with 1985–1986: The National Heart, Lung, and Blood Institute Registries. *Circulation* 2000;**102**:2945–51.
13. Grayson AD, et al. Multivariate prediction of major adverse cardiac events after 9,914 percutaneous coronary interventions in the north west of England. *Heart* 2006;**92**:658–63.
14. Webb JG, et al. Incidence, correlates, and outcome of cardiac arrest associated with percutaneous coronary intervention. *Am J Cardiol* 2002;**90**:1252–4.
15. Schwartz DE, et al. Death and other complications of airway management in critically ill adults. *Anesthesiology* 1995;**82**:367–76.
16. McCullough PA, et al. Acute renal failure after coronary intervention: incidence, risk factors, and relationship to mortality. *Am J Med* 1997;**103**:368–75.