Jejunostomy tube feeding in patients undergoing esophagectomy

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Background: Surgical jejunostomy tubes are a routine part of elective esophagectomies in patients with carcinomas and provide a route for nutritional support in those who experience complications. We wished to determine how frequently oral intake is delayed and the amount of nutrition delivered via the jejunostomy tube.

Methods: We reviewed the charts of all adults undergoing esophagectomy for carcinoma between January 2000 and June 2008. We determined the proportion of patients unable to resume oral nutrition after 8 days and the amount of nutrition delivered in each of the 8 days.

Results: In all, 111 patients underwent elective esophagectomy for carcinoma, and 103 had a jejunostomy tube placed. The mean age was 67 ± 10.8 years. The median time to oral intake was 7 (interquartile range 7–11) days. Seventy-four (67%) patients resumed oral intake within 8 days. The mean nutrition delivered by jejunostomy within the first 8 days as a percentage of the target was 45.6% (95% confidence interval 41.2%–49.9%). Six (5.4%) patients experienced complications attributable solely to the jejunostomy tube; 3 (2.9%) required surgery. Forty (38.8%) patients had abdominal issues serious enough to warrant delaying the progression of feeding.

Conclusion: Two-thirds of patients undergoing elective esophagectomy were tolerating oral intake by the end of the eighth postoperative day, and less than half of the target nutrition was delivered over the first 8 days. We now selectively place surgical jejunostomy tubes in patients undergoing elective esophagectomies.

Contexte : Des cathéters de jéjunostomie chirurgicale sont d'emblée posés lors des œsophagectomies non urgentes chez les patients atteints de cancer et procurent une voie d'administration du soutien nutritionnel chez les patients qui présentent des complications. Nous avons voulu déterminer la fréquence à laquelle la prise orale est retardée et la quantité de solution pour nutrition parentérale administrée par le cathéter de jéjunostomie.

Méthodes : Nous avons analysé les dossiers de tous les adultes soumis à une œsophagectomie pour un cancer entre janvier 2000 et juin 2008. Nous avons calculé la proportion de patients incapables de recommencer à se nourrir par la bouche après 8 jours et la quantité de solution administrée à chacun des 8 jours.

Résultats : En tout, 111 patients ont subi une œsophagectomie non urgente pour un cancer et on a posé un cathéter de jéjunostomie à 103 d'entre eux. L'âge moyen était de 67 ± 10,8 ans. L'intervalle médian avant le début des prises orales a été de 7 jours (fourchette interquartile de 7–11). Soixante-quatorze patients (67 %) ont recommencé à s'alimenter par la bouche en l'espace de 8 jours. La quantité moyenne de solution pour nutrition parentérale administrée par jéjunostomie au cours des 8 premiers jours en pourcentage de l'objectif cible a été de 45,6 % (intervalle de confiance [IC] de 95 %, 41,2 %–49,9 %). Six patients (5,4 %) ont présenté des complications attribuables uniquement au cathéter de jéjunostomie; 3 (2,9 %) ont eu besoin d'une chirurgie. Quarante patients (38,8 %) ont présenté des symptômes abdominaux suffisamment graves pour retarder la progression de l'alimentation.

Conclusion : Les deux tiers des patients soumis à une œsophagectomie non urgente toléraient la prise orale à la fin du huitième jour postopératoire et moins de la moitié de la nutrition cible a été administrée au cours des 8 premiers jours. Nous plaçons maintenant des cathéters de jéjunostomie chirurgicale de façon sélective chez les patients qui subissent des œsophagectomies non urgentes.

In Canada, surgical jejunostomy tubes are routinely placed at the time of elective esophagectomy when oral nutrition is expected to be commenced after the first postoperative week. A potential benefit of placing a surgical jejunostomy tube is to provide a "safety valve" in case of delay in the resumption of oral intake. Another reason is to provide early enteral nutrition to reduce perioperative complications. Therefore, surgical jejunostomy is a prophylactic intervention analogous to perioperative antibiotics or anticoagulation.

However, as for any prophylactic procedure, there will be patients who receive the intervention in whom no benefit is expected but who are nevertheless exposed to the risk of the intervention. We sought to understand the possible benefits and risks associated with the routine insertion of surgical jejunostomy tubes in patients undergoing elective esophagectomy for carcinoma.

We conducted a retrospective cohort study to determine first, the frequency of delayed oral intake (i.e., how often did the jejunostomy serve as the "safety valve"?); second, how much nutrition was actually delivered within the first 8 postoperative days; and third, the frequency and nature of adverse events associated with jejunostomy tubes.

Methods

Clinical protocol

At the Health Sciences Centre in Winnipeg, Man., we generally perform a transhiatal procedure[1] and place a jejunostomy tube using a Witzel technique and a 10 or 12 F soft silicone catheter.[2] Other procedures, such as thoracoabdominal or Ivor–Lewis procedures, are performed if deemed more suitable.

For patients having a surgical jejunostomy tube placed, dextrose solution is infused through the jejunostomy tube starting at a rate of 25 mL/h on postoperative day 1. On postoperative day 2, a standard polymeric formula is started at a rate of 25 mL/h administered by continuous infusion via automated Kangaroo ePump (Covidien) and advanced at a rate of 10–15 mL every 8–10 hours up to the target rate for that patient, depending on patient tolerance. The surgical team, in consultation with the dietician, determines the rate of advance.

On postoperative day 6 or 7, anastomotic integrity is confirmed with a contrast study, and the patient is started on clear fluids by mouth on postoperative day 7 or 8, depending on the timing of the contrast study. Tube feeding is decreased when the diet is advanced to full fluid consistency and is discontinued before the patient is discharged from hospital.

Study protocol

After obtaining University of Manitoba Health Research Ethics Board approval, we consulted hospital records to identify patients who had undergone surgical procedures on the esophagus at the Winnipeg Health Sciences Centre between Jan. 1, 2000, and June 30, 2008. Adults older than 18 years who underwent an elective esophagectomy for carcinoma were included.

Data collection

From the patient notes, we collected details of preoperative status, disease characteristics and operative details. For each patient, we calculated the daily delivered volume of tube feed and their target volumes.

Definitions

We classified dysphagia as none or minimal, tolerating liquids or obstructed. Because we were not confident in deriving a formal dysphagia score from the chart, we did not do so. Weight loss was determined at the time of the dietician assessment and recorded in the patient's chart; however, the information in the chart did not allow for an accurate determination of the time period in which weight loss occurred.

We considered the time to oral intake to be the date of operation to commencement of any oral intake.

Statistical analysis

All patients were classified as having commenced oral intake by the end of postoperative day 8 (early) or not (delayed). We compared these 2 groups according to routinely measured perioperative factors. In those with jejunostomy tubes, the amount of nutrition delivered is expressed as a percentage of the target volume required for each patient, as determined by the Harris–Benedict equation and the specific nutritional formula used. The amount delivered each day during the first 8 postoperative days and the total amount delivered during this period is presented. We calculated 95% confidence intervals (CIs) for estimates of amount of nutrition delivered and proportions of patients who were unable to take oral intake by day 8. We did not undertake formal tests of significant differences between groups.

Results

From Jan. 1, 2000, to June 30, 2008, 111 patients underwent an elective esophagectomy (95 men and 16 women). The type of operations performed were transhiatal esophagectomhy (n = 64), thoracoabdominal or combined abdominal and thoracic (n = 44) and Ivor Lewis procedure with a neck anastomosis (n = 3). There were 69 patients who had the anastomosis placed in the neck and 42 had the anastomosis placed in the chest.

The mean body mass index was 26.9 ± 4.5, and the mean weight loss was 9.1% ± 8.1% of the usual weight. Before the operation, 59 patients had normal oral intake, 35 could manage only liquids and 10 were obstructed; we

were unable to determine preoperative oral intake status in 7 patients (Table 1).

Of the 111 patients, 103 had a surgical jejunostomy tube placed at the time of esophagectomy. The 8 patients without a jejunostomy tube received total parenteral nutrition (TPN) for nutritional support.

The median time to oral intake in all esophagectomy patients was 7 (interquartile range 7–11) days.

There were 74 patients (67%, 95% CI 57%–75%) who resumed oral intake by postoperative day 8 (Table 2). In the 37 patients in whom oral intake was delayed, 23 had a documented anastomotic leak and 14 had other complications, such as respiratory failure, gastric dilation or sepsis. Of these 37 patients with delayed oral intake, 28 received prolonged nutritional support via their jejunostomy tubes and 9 commenced TPN owing to complications, including jejunostomy tube failure.

In the 103 patients who had a jejunostomy tube placed at operation, the overall nutritional intake through the jejunostomy tube was a mean of 45.6% (95% CI 41.2%–49.9%) of the target. In the early group, the mean nutrition delivered was 47.9% (95% CI 42.8%–52.9%) of the target and in the delayed group, the mean nutrition delivered during the first 8 days was 41.0% (95% CI 32.6%–49.5%) of the target.

The pattern of nutritional delivery was variable for both groups, but overall there was a slow increase toward the target, which often took until postoperative day 5 or 6 to reach the target (Fig. 1).

Table 1. Characteristics of patients who underwent elective esophagectomy for carcinoma and received or did not receive a jejunostomy tube

Characteristic	Total	Tube	No tube
Total no. (%)	111	103	8
Age, mean ± SD, yr	64.7 ± 10.8	64.5 ± 11	66.4 ± 9.4
Sex, no. (%)			
Female	16 (14.4)	16 (15.5)	0
Male	95 (85.6)	87 (84.5)	8 (100)
Body mass index, mean ± SD	26.9 ± 4.5	26.9 ± 4.5	27.1 ± 5.3
Dysphagia, no. (%)			
None/minimal	59 (53.2)	53 (51.3)	6 (75.0)
Fluid only	35 (31.5)	34 (33.0)	1 (12.5)
Obstructed	10 (9.0)	9 (8.7)	1 (12.5)
Unable to determine	7 (6.3)	7 (6.8)	0
Weight loss, mean ± SD, %	–9.1± 8.1	–9.3 ± 7.9	–6.3 ± 10.9
Stage, no. (%)			
Stage 0	2 (1.8)	2 (2)	0
Stage 1	7 (6.4)	6 (5.9)	1 (12.5)
Stage 2a	9 (8.2)	8 (7.8)	1 (12.5)
Stage 2b	29 (26.4)	26 (25.5)	3 (37.5)
Stage 3	53 (48.2)	50 (49.0)	3 (37.5)
Stage 4	10 (9.1)	10 (9.8)	0
Operation performed, no. (%)			
THE/laparotomy	64 (57.7)	60 (58.3)	4 (50)
Thoracoabdominal/thorocotomy	44 (39.6)	40 (38.8)	4 (50)
Ivor Lewis McKeown	3 (2.7)	3 (2.9)	0

SD = standard deviation; THE = transhiatal esophagectomy.

Six patients, 3 of whom were in the early group, experienced complications attributable to the jejunostomy tube itself. Of the 6 patients, 3 required surgery for these complications (Tables 3 and 4). In addition to the observed complications attributable to the jejunostomy tube, the tube was blocked in 7 patients and dislodged in 2 patients. Forty patients (38.8%, 95% CI 29.3%–48.9%) reported abdominal issues serious enough to warrant withholding the progression of feeding.

Discussion

Our study found that 66% of patients were able to commence oral intake by the end of 8 postoperative days. During this time period, 47.9% of the target nutrition was actually delivered.

In other words, for every 100 patients who undergo an elective esophagectomy for cancer, 66 will have undergone a surgical procedure that was unnecessary as a "safety valve." In addition, those patients who had a jejunostomy tube placed received less than half of the target nutrition, calling into question our success in actually providing early enteral nutrition.

Overall 40 patients had abdominal pain, diarrhea or other issues serious enough to warrant withholding their tube feeds, and 3 patients experienced jejunostomy complications severe enough to require reoperation.

Table 2. Characteristics of patients who underwent elective esophagectomy for carcinoma and who did or did not resume oral intake within 8 postoperative days

Characteristic	Oral intake within 8 days	Oral intake after 8 days
Total no. (%)	74 (67)	37 (33)
Age, mean ± SD, yr	64.4 ± 11	65.3 ± 10.7
Sex, no. (%)		
Female	10 (13.5)	6 (16.2)
Male	64 (86.5)	31 (83.8)
Body mass index, mean ± SD	26.4 ± 4.3	27.9 ± 4.8
Dysphagia, no. (%)		
None/minimal	38 (51.3)	21 (58.3)
Fluid only	25 (33.8)	10 (27.8)
Obstructed	4 (8.7)	5 (13.9)
Unable to determine	7 (6.8)	0
Weight loss, mean ± SD, %	–8.8 ± 7.8	–9.7 ± 8.8
Stage, no. (%)		
Stage 0	1 (1.4)	1 (2.8)
Stage 1	4 (5.4)	3 (8.3)
Stage 2a	7 (9.5)	2 (5.6)
Stage 2b	20 (27.0)	9 (25.0)
Stage 3	35 (47.3)	18 (50.0)
Stage 4	7 (9.5)	3 (8.3)
Operation performed, no. (%)		
THE/laparotomy	40 (54.1)	24 (64.9)
Thoracoabdominal/thorocotomy	31 (41.9)	13 (35.1)
Ivor Lewis McKeown	3 (4.1)	0

SD = standard deviation; THE = transhiatal esophagectomy.

The jejunostomy tube complication rates and the rate of gastrointestinal symptoms, which limit tube feed delivery, observed in our study are in keeping with the rates reported in the literature.[2–6]

Our findings that only half the intended nutrition is actually delivered are similar to those of many authors who report a high incidence of difficulties meeting targets,[7–15] though isolated reports of very high success rates exist.[3,16,17] Mechanical difficulties and symptoms, such as diarrhea and abdominal pain, that limit advancement of tube feeds and subsequent delivery of nutrition are responsible for the generally limited success in achieving targets. Given that close to 40% of patients had gastrointestinal symptoms severe enough to decrease feed rates or stop feeding altogether (as recorded in their charts), this is a plausible reason for the total delivery of nutrition in our study population.

The variation in success with tube feeding across studies could be due to the specifics of the protocol, such as the use of rest periods and rate of advancement. The timing and rate of advancement that we used was in keeping with protocols used in other centres in Canada and worldwide. We did not use rest periods during feeding, whereas others have.[13,17] Lobo and colleagues[13] reported achieving 77%–95% of the target on postoperative day 3 in the 2 arms of their trial of immune modulated nutrition. Ryan and colleagues[17] reported 96%–98% of the target reached in the 2 arms of their study. Even in these studies, the target was not reached until postoperative day 3, and our patients started oral intake 4 days after.

It could be argued that even a small amount of nutrition is better than none, but the evidence for the effectiveness of early nutrition in postoperative patients is poor. A number of randomized trials have compared small bowel feeding to hydration alone or to parenteral nutrition in patients undergoing esophageal or gastric surgery. No trials enrolling patients with predominantly upper gastrointestinal surgery have shown a benefit in septic complications, anastomotic failure or any other clinical measures.[8–11,16] In 2001, Lewis and colleagues[18] performed a systematic review of randomized trials comparing enteral feeding to nil by mouth and concluded that there was insufficient evidence for the benefit of early small bowel feeding. Although some reports maintain that there is improvement in measures of gut function, it has not resulted in clinical differences. In a more recent meta-analysis comparing enteral to parenteral

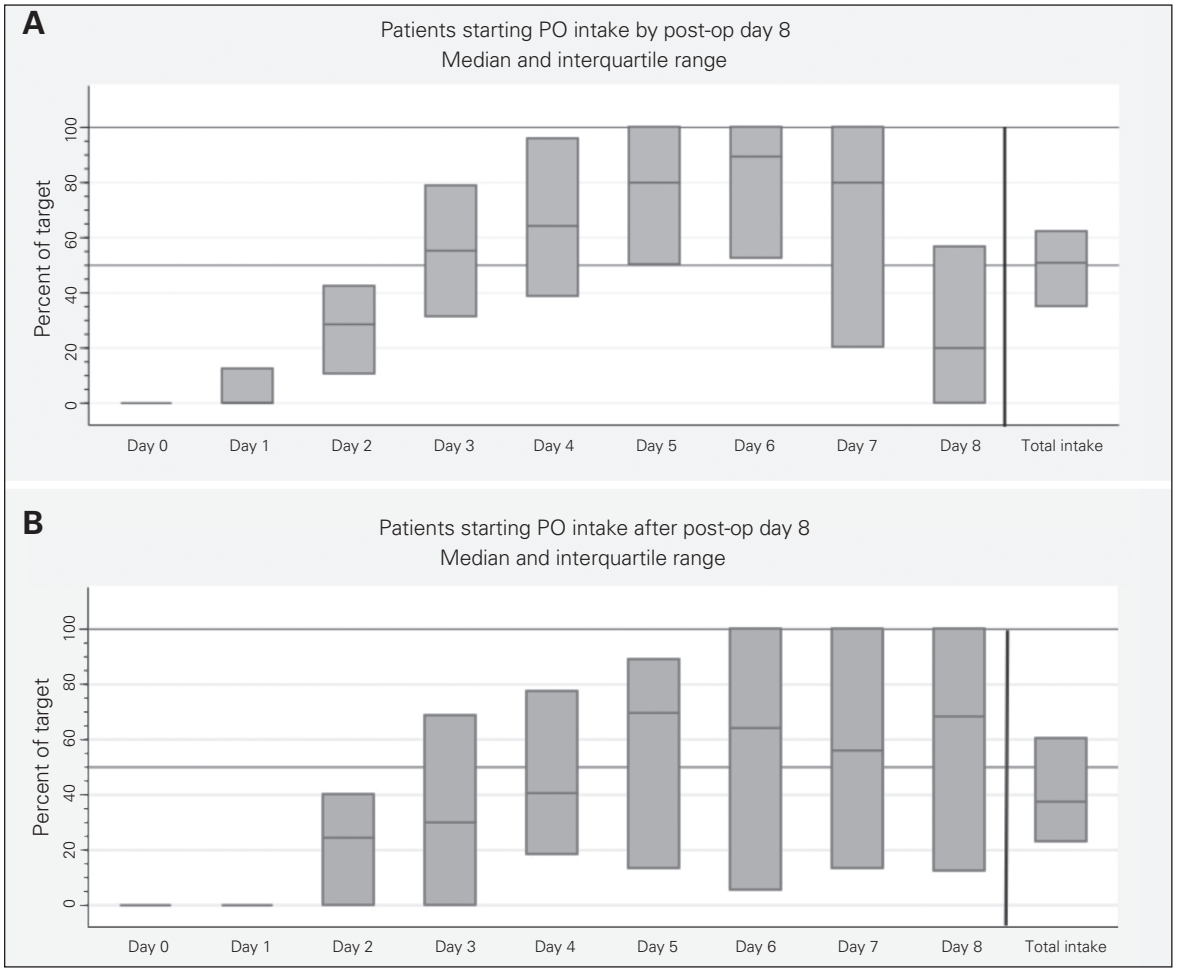

Fig. 1. Patients who started eating by mouth (PO) **(A)** by postoperative day 8 and **(B)** after postoperative day 8. Values shown are means and interquartile ranges.

nutrition, Mazaki and Ebisawa[19] reported possible benefits of enteral nutrition over parenteral nutrition in surgical patients, but they raised a note of caution in their findings because of the incidence of adverse events, which was similar to that in our study. These adverse events included leaking tubes, vomiting, diarrhea and abdominal distention. Observational studies have also documented complications associated with early enteral nutrition, including rare but very serious events (perforation of the small bowel, small bowel necrosis),[20] and less serious but common events (vomiting, diarrhea, bloating, abdominal pain).[8–10,13,19,21]

It has been argued that routine jejunostomy tubes provide a "safety valve" in case of complications precluding timely commencement of oral intake. However, this policy subjects patients who may never require prolonged nutritional support (67% in our study) to the risks and discomforts of the intervention. If jejunostomy tubes rarely caused adverse events, this policy could be justified; however, adverse events occurred frequently in our study and in virtually every other study published.

Strengths

We have presented an estimate of the frequency of delayed oral intake and a detailed description of tube feeding, including the extent of meeting nutritional targets and the adverse events associated with the use of jejunostomy tubes. We have presented quantitative information that may help surgeons decide whether to continue using jejunostomy feeds early in the postoperative course.

Limitations

We cannot make a definitive statement about the overall benefit of routine feeding jejunostomy compared with an alternative in these patients. The present study was not a comparative study about the efficacy of jejunostomy tubes, nor was it designed to determine whether patients with jejunostomy tubes fared better than those without. Only a clinical trial can answer this question.

Given the goal of our study, its major weakness is that we had to limit the data of interest to those that were not only measured but also recorded in a reliable manner. It is likely that some complications, such as abdominal discomfort insufficient to warrant adjusting feed rates, have been under-reported.

In calculating the amount of nutrition delivered, we had to make a number of assumptions, the main one being that there was a constant rate of tube feeding between measurements. It is unclear how this assumption may have altered our findings.

Implications

The patients, the type of operation and the main outcomes in our study were similar to those in other reports. This suggests that our findings are likely to be generalizable to other settings with similar strategies of managing postoperative esophagectomy patients. Our results highlight that a feeding jejunostomy is not a benign surgical intervention. The jejunostomy tube itself is a source of complications, which at times can be life-threatening but more frequently a source of discomfort and distress.

The clinical benefit of routine tube feeding in the typical patient remains uncertain, but it is clear that complications, such as intraperitoneal leak or bowel necrosis,[20] can occur. A major complication rate of 3% is clinically important in the face of unproven benefits from an essentially prophylactic intervention. In the absence of reasonable evidence of benefit from an intervention, we maintain that it is unreasonable to put patients at risk of well-documented harms. Further, episodes of diarrhea, pain and nausea after patients have undergone surgery as demanding as an esophagectomy should not simply be dismissed as minor discomforts. We

Table 3. Outcomes of patients who underwent elective esophagectomy for carcinoma and who did or did not resume oral intake within 8 postoperative days

Outcome	Oral intake within 8 days	Oral intake after 8 days
Days to start oral intake, median (interquartile range)	7 (7–7)	15 (11–23)
Complications, no.	29/74	36/37
Anastomotic leaks, no.	4/74	23/37
Days of tube feeding, median (interquartile range)	6 (5–7)	14.5 (8–21)
Abdominal issues requiring feeding to be withheld, no.	23/68	17/35

Table 4. Jejunostomy complications

Patient	Days to oral intake	Days to jejunostomy tube complication	Complication	Treatment
1	12	7	Jejunal ischemia	Localized resection
2	62	8	Bowel obstruction and perforated jejunum	Localized resection
3	NA*	13	Small bowel leak and localized abscess	Repair of jejunum
4	11	10	Jejunal site infection	Tube removed
5	52	49	Jejunal site infection	Tube removed
6	8	6	Jejunal site infection	Antibiotics

NA = not applicable.
*Patient died on postoperative day 27 without having resumed oral intake.

believe that the instruction to "first do no harm" holds true.

Given our findings, it seems reasonable to adopt the practice of using feeding jejunostomy tubes in patients who the surgeon feels are at elevated risk for anastomotic failure, which will delay commencement of oral intake. In patients who require nutritional support, the options of a nasojejunal tube, TPN or postoperative insertion of a jejunostomy tube remain. These alternative interventions have their own associated complications, but in contrast to their routine use in all patients undergoing esophagectomy, these complications will be limited to the minority of patients who have a therapeutic need for the intervention.

It is possible that the routine use of a jejunostomy tube in patients undergoing elective esophagectomy is in fact justified to reduce postoperative complications, such as anastomotic failure and sepsis. It is also possible that for those centres that believe in prolonged limitation of oral intake after surgery and in use the jejunostomy tube for nutritional support during this time, the trade-off of complications to benefits may be reasonable. But determining the overall balance of risks and benefits of routine jejunostomy tube feeding in the immediate postoperative period requires a randomized trial powered to detect differences in mortality and that will carefully account for all complications and adverse events, including "minor" ones, such as pain and diarrhea. Such a study must consider the extent and timing of weight loss in the participating patients, the type of surgery they undergo and the extent to which they actually receive the intended amount of nutrition, since it remains unknown how much nutrition is actually "enough" to bring about a benefit.

Conclusion

We have demonstrated that among patients who underwent elective esophagectomy for cancer and received a jejunostomy tube, two-thirds did not require the tube as a "safety valve." Tube feeding provides less than half of the target nutrition we wish to deliver. For certain patients, such as those with substantial weight loss before surgery, a jejunostomy tube may be reasonable. In patients unable to take oral nutrition after a week owing to a complication, many options remain.

Jejunostomy tubes can lead to serious complications and frequent but less serious adverse events in a group of patients already at high risk for complications. We feel that it is unreasonable to subject two-thirds of patients to a procedure that has been proven to cause harm in the absence of convincing evidence in the literature that this intervention is of clinical benefit.

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Competing interests: None declared.

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