ORIGINAL ARTICLE

Gut and Liver, Vol. 8, No. 5, September 2014, pp. 495-499

T-Fastener Migration after Percutaneous Gastropexy for Transgastric Enteral Tube Insertion

Ryan H. Sydnor, Stacey M. Schriber, and Charles Yoon Kim

Division of Vascular and Interventional Radiology, Duke University Medical Center, Durham, NC, USA

Background/Aims: To determine the prevalence and time-course of t-fastener migration after gastropexy deployment. **Methods:** We reviewed our procedural database for all percutaneous gastrostomy and gastrojejunostomy tube insertions performed over a 14-month period using a widely accepted t-fastener kit for gastropexy (Kimberly-Clark). Of 201 patients, 71 (41 males, 30 females; mean age, 56 years) underwent subsequent abdominal computed tomography (CT) imaging. The location and associated findings of each t-fastener were retrospectively recorded for each CT scan performed after the tube insertion. **Results:** A total of 153 t-fasteners were deployed during 71 procedures with subsequent CT follow-up. In the short term (within 4 weeks after deployment), 5.1% of the t-fasteners had detached and were no longer present; 59.5% were intraluminal or within the gastric wall; and 35.5% were within the anterior abdominal wall musculature or subcutaneous. In the long term (>3 months), 48.6% of the t-fasteners had detached and were no longer present, 25.0% were intraluminal or within the gastric wall, and 26.4% were within the anterior abdominal wall musculature or subcutaneous. No t-fastener-related complications, such as abscesses, fluid collections, or fistulae, were identified. **Conclusions:** Following gastropexy for percutaneous transgastric feeding tube placement, t-fastener migration into the abdominal wall frequently occurred soon after the tube insertion. Therefore, recent t-fastener deployment does not guarantee an intact gastropexy. **(Gut Liver 2014;8:495-499)**

Key Words: T-fasteners; Gastropexy; Gastrostomy tube; Gastrojejunostomy tube

INTRODUCTION

The use of t-fasteners for gastropexy during percutaneous radiologic gastrostomy was first described by Brown *et al*.[1] in 1986[2,3] and has since become routine practice. A t-fastener consists of a tiny metal bar attached to a thread or suture that can be advanced through a needle in order to secure the anterior gastric wall to the anterior abdominal wall. Brown *et al*.[1] originally recommended removal of t-fasteners 2 weeks following the procedure, theorizing that a mature tract would make continued gastropexy unnecessary by virtue of adhesion of the stomach to the anterior abdominal wall. However, there exists no evidence for the optimal time point at which t-fastener release should be performed, and in fact, some t-fasteners employ absorbable sutures intended to avoid the need for intentional severing of the suture.

One purported advantage of late t-fastener release is the ability to replace a dislodged or clogged tube early after initial insertion prior to tract maturation, by virtue of an intact t-fastener gastropexy.[1-3] However, it is difficult to know whether or not the gastropexy is truly intact. While the presence of t-fasteners may be confirmed using fluoroscopy, their actual location (intraluminal vs extraluminal) cannot be known without cross-sectional imaging such as computed tomography (CT). Thus, knowledge of the incidence of t-fastener migration would be crucial when early tube exchange is being considered. Therefore, the purpose of this study is to determine the prevalence and time-course of t-fastener migration after deployment for gastropexy.

MATERIALS AND METHODS

This retrospective study was approved by our Institutional Review Board. A waiver of informed consent was obtained. All successful *de novo* insertions of percutaneous gastrostomy

Correspondence to: Charles Yoon Kim
Division of Vascular and Interventional Radiology, Duke University Medical Center, Box 3808, Durham, NC 27710, USA
Tel: +1-919-684-7424, Fax: +1-919-684-7148, E-mail: charles.kim@dm.duke.edu
Received on June 4, 2013. Revised on August 20, 2013. Accepted on August 21, 2013. Published online on February 24, 2014
pISSN 1976-2283 eISSN 2005-1212 http://dx.doi.org/10.5009/gnl13204

and gastrojejunostomy tubes using t-fastener gastropexy performed between January 2008 and March 2009 were identified from our procedural database. Out of these 201 patients, 71 (41 males, 30 females; mean age, 56 years) underwent subsequent CT imaging of the abdomen within 1 year of enteral tube placement. The enteral tubes placed included nine gastrostomy tubes and 62 gastrojejunostomy tubes. Clinical notes and imaging studies were retrospectively reviewed.

1. Gastrostomy and gastrojejunostomy tube insertion technique

All procedures were performed in the interventional radiology suites by an attending physician or a fellow under the direct supervision of an attending physician. Patients were administered barium orally or via a nasogastric tube the day before the scheduled procedure in order to allow opacification of the transverse colon. Radiographic confirmation of such opacification was required prior to initiating the procedure. Moderate sedation was achieved using midolazam and fentanyl. Prophylactic antibiotics were not routinely administered. The stomach was insufflated with air via a nasogastric tube. If an adequate window for gastric access was available below the costal margin and above the transverse colon, then the procedure was initiated. If no adequate window was present, then the procedure was aborted and considered a technical failure. For local anesthesia, 1% lidocaine was utilized. Two to four t-fasteners (Saf-T-Pexy; Kimberly-Clark, Roswell, GA, USA) were then used to perform gastropexy at separate sites around the planned access site (Fig. 1). The number of t-fasteners used was at the discretion of the attending physician. At the center of the gastropexy, the stomach was accessed with an 18-gauge needle. For gastrojejunostomy tubes, transpyloric access to the proximal jejunum was obtained using a 5-Fr angled catheter and guidewire. Tract dilation was performed over a stiff guidewire to allow insertion of a 24-Fr peel away sheath. An 18-Fr MIC G-tube or GJ-tube (Kimberly-Clark) was then inserted over a guidewire through the peel away sheath, which was then removed. Contrast was injected to confirm appropriate intraluminal positioning. The procedure was deemed a technical success if both ports were demonstrated to be intraluminal. A procedural complication was deemed present if any unexpected events occurred directly related to enteral tube insertion that resulted in prolongation of hospitalization or requiring additional therapies.

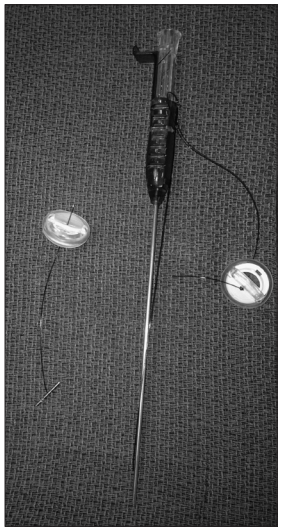

Fig. 1. A photograph of a deployed t-fastener (left) and a t-fastener needle containing an undeployed t-fastener.

2. Image review

All CT scans performed after percutaneous enteral tube insertion were retrospectively reviewed. T-fastener location was categorized into various time intervals based on the interval between t-fastener insertion and CT acquisition. For patients with more than one CT in a given time interval, only the data from the latest CT was utilized for that patient so that patients with multiple CT scans were not counted more than once in any given calculation.

The number of t-fasteners deployed was ascertained from the procedural note. For each CT scan, the location of each t-fastener was recorded. The phenomenon of tissue tenting was considered when determining the location of the t-fasteners as follows. If the t-fastener was visualized at the inner margin of the gastric wall or apparently within the gastric wall, then it was categorized as intragastric (Fig. 2A). If the t-fastener was visualized at the interface of the outer portion of the gastric wall, then the location was considered within the gastric wall (Fig. 2B). If the t-fastener was clearly outside of the stomach wall and within the abdominal musculature or adjacent to the peritoneum, it was categorized as within the abdominal wall musculature (Fig. 2C). If the t-fastener was outside of the abdominal wall in the subcutaneous tissues, it was categorized as subcutaneous (Fig. 2D). A t-fastener that is intraluminal or within the gastric wall was considered as an intact gastropexy, while t-fasteners within the abdominal musculature or subcutaneous tissues was considered as a nonintact gastropexy. T-fasteners that were not visualized anywhere in the vicinity of the stomach were assumed to have detached and passed enterally. The CT scout image was also reviewed to ensure that a t-fastener was not missed due to volume averaging. In addition to the location of each t-fastener, associated imaging findings such as fluid collections, sinus tracts, or suspicious fat stranding were sought as potential evidence of t-fastener-associated abscess, fistulization, or cellulitis, respectively. Subsequent clinical notes were searched for any clinical evidence of t-fastener-related infection or fistula formation.

3. Statistical analysis

Comparison of t-fastener position in the short-term (<4 weeks) to long-term (>3 months) was performed using the chi-

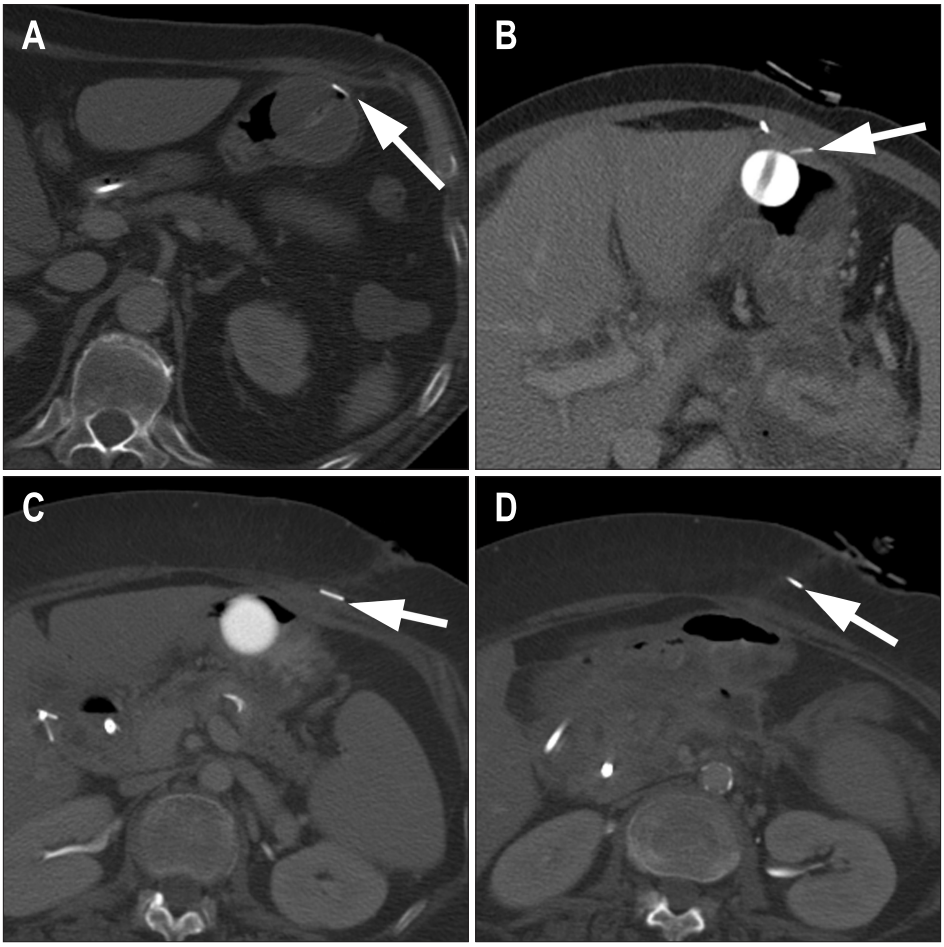

Fig. 2. Computer tomography images demonstrating the four t-fastener location categories. The white arrows denote the t-fastener of interest: (A) intraluminal, (B) gastric wall, (C) abdominal musculature, and (D) subcutaneous.

square test, with a $p \leq 0.05$ being considered statistically significant.

RESULTS

During 71 transgastric enteral tube placements with subsequent CT imaging, a total of 153 individual t-fasteners were deployed for gastropexy. The technical success rate was 100%. No procedural complications identified. T-fastener migration through tissue planes varied greatly among patients, and in some cases among t-fasteners within an individual patient (Table 1). Since most patients had only one CT, the following results at each time-point represent separate cohorts of patients with only minor overlap (i.e., CT was not performed at each time point on a single patient population).

1. Short-term t-fastener position

Of the 55 t-fasteners in 27 patients imaged within two weeks of tube placement, 3.6% (n=2) had detached and were no longer visible. Gastropexy was intact in 65.5% (36.4% [n=20] of t-fasteners were intragastric and 29.1% [n=16] were within the gastric wall) and not intact in 30.9% (17 t-fasteners were within the anterior abdominal wall). Of the 79 t-fasteners in 37 patients imaged within 4 weeks of tube placement, 5.1% (n=4) had detached and were no longer visible. Gastropexy was intact in 59.5% (30.4% [n=24] of t-fasteners were intraluminal and 29.1% [n=23] were within the gastric wall) and not intact in 35.5% (30.4% [n=24] of t-fasteners were within the anterior abdominal wall and 5.1% [n=4] were subcutaneous).

2. Long-term t-fastener position

Analysis of t-fasteners imaged later than 3 months after gastropexy revealed 72 t-fasteners in 32 patients, with 48.6% t-fasteners detached (n=35), 11.1% intraluminal (n=8), 13.9% in the gastric wall (n=10), 25.0% in the abdominal wall (n=18), and 1.4% in the subcutaneous tissues (n=1).

3. Impact of time frame on t-fastener location

The proportion of t-fasteners that had detached was significantly higher in the long term (>3 months) compared to short term (<1 months) (48.6% vs 5.1%; $p < 0.001$). However, the proportion of t-fasteners in the abdominal wall or subcutaneous tissues was not significantly different between the long and short term (26.4% vs 35.4%; p=0.29).

Table 1. The T-Fastener Locations at Various Time Points for 153 T-Fasteners Deployed in 71 Patients

	<2 wk	2–4 wk	<4 wk	1–3 mo	<3 mo	3+ mo	Total
Detached	2 (3.6)	3 (8.3)	4 (5.1)	24 (35.3)	28 (23.1)	35 (48.6)	54 (35)
Intraluminal	20 (36.4)	10 (27.8)	24 (30.4)	18 (26.5)	33 (27.3)	8 (11.1)	29 (19)
Gastric wall	16 (29.1)	8 (22.2)	23 (29.1)	11 (16.2)	26 (21.5)	10 (13.9)	26 (17)
Abdominal muscle	17 (30.9)	11 (30.6)	24 (30.4)	14 (20.6)	30 (24.8)	18 (25.0)	39 (25)
Subcutaneous	0	4 (11.1)	4 (5.0)	1 (1.5)	4 (3.3)	1 (1.4)	5 (3)
#T-fasteners	55	36	79	68	121	72	153
#Patients	27	16	37	32	57	32	71

Data are presented as the number of t-fasteners or patients (%). The numbers for the cumulative time-points do not necessarily equal the sum of the individual intervals because some patients had multiple computed tomography scans. Furthermore, some, but not all, of the time categories are cumulative.

4. Sequelae of t-fastener migration

No t-fastener related complications, such as abscesses, cellulitis, significant hemorrhage, fluid collections, or fistulae, were identified on any of the imaging studies or clinical notes reviewed.

DISCUSSION

The purpose of t-fastener gastropexy is 3-fold.[1] First and most importantly, the gastropexy allows percutaneous dilation of the tract to allow insertion of a large bore enteral tube. Second, it theoretically aids in tract maturation by forcing the gastric wall to remain apposed to the abdominal wall. Finally, if tube dislodgement occurs prior to tract maturation, it is thought that t-fasteners may prevent spillage of gastric contents into the peritoneal cavity.

Although t-fastener gastropexy is used routinely for transgastric enteral tube insertion, the actual role of the t-fasteners in tract maturation is unknown. Prior studies of gastrostomy tube insertion without gastropexy in animals demonstrated the formation of adhesions between the gastric and abdominal walls after approximately 2 days and mature gastrocutaneous fistula tract formation after 1 to 2 weeks.[4,5] Insertion and immediate removal of 14 Fr gastrostomy tubes without gastropexy in dogs was not associated with intraperitoneal leakage or clinical peritonitis.[6] In a porcine model, the rate of tract maturation was similar with and without t-fastener gastropexy.[7] However, in humans, a randomized trial of t-fastener use revealed major complications in 10% of patients who underwent percutaneous radiologic gastrostomy without gastropexy versus none in the gastropexy group, thus supporting the use of t-fasteners.[8]

Despite these studies, it is still generally held that maintenance of the early percutaneous tract is one of the primary benefits of t-fastener gastropexy.[3] When tube replacement is required during the first few weeks following initial placement in the setting of t-fastener gastropexy, multiple investigators have concluded that such replacement is safe, since the t-fasteners are assumed to be still intact and intraluminal.[1-3] However, the results of this study suggest that this is an invalid assumption, as nearly a third of t-fasteners have migrated into the anterior abdominal wall within the first 2 weeks following deployment. Insertion of a tube or tract dilation without an intact gastropexy may be prone to displacement of the anterior gastric wall with an increased chance for intraperitoneal tube insertion. Even if one or more t-fasteners have migrated, one remaining intact and intraluminal t-fastener is likely to be adequate for tube exchange or replacement.[9] Alternatively, an additional t-fastener could be prophylactically deployed at the time of tube exchange or replacement.

T-fastener sutures are subjected to a variable amount of tension that is determined by operator technique at the time of t-fastener securement. Additional forces may also exert tension, as may occur with changes in gastric position and configuration based on patient position (supine vs upright), body habitus, or gastric distention. Higher degrees of tension may predispose t-fasteners to migration through tissues planes. Our results demonstrated that the proportion of t-fasteners in the abdominal wall or subcutaneous tissues is similar in the short and long term, thus suggesting that t-fastener migration occurs very soon after, or possibly during enteral tube insertion, with the minority migrating after a month. We hypothesize that t-fastener migration may be particularly prone to occur during tract dilation to 24 Fr, where the t-fasteners are subjected acutely to a very high degree of tension. Intraluminal positioning of t-fastener needles were confirmed prior to deployment in all cases, and thus maldeployment of t-fasteners within the gastric or abdominal wall should be minimal.

The t-fasteners studied in this report utilize an absorbable suture made of a synthetic polyester (3-0 Biosyn; Covidien, Mansfield, MA, USA).[10] Progressive loss of tensile strength and eventual absorption occurs by means of hydrolysis into absorbable byproducts. The suture maintains adequate strength for wound closure until 3 weeks, becoming completely absorbed

between 90 to 110 days. The advantage of an absorbable suture is that it does not have to be intentionally severed in follow-up and will not leave a permanent foreign body leading from the gastric lumen to the skin, which could serve as a nidus for fistula.[11] Accordingly, we found that significantly more t-fasteners had detached and passed through the gastrointestinal tract in the long term compared to short term. However, at greater than 3 months, more than half of t-fasteners were still retained, likely due to embedding into the tissues of the stomach or migration into the abdominal wall.

Complications related to directly to t-fastener gastropexy are rare.[3] A single case report described the complication of intraperitoneal leakage of gastric contents due to a sinus tract caused by a nonabsorbable t-fastener suture.[11] In this case, the gastrostomy tube was removed 3 weeks prior to presentation for an acute abdomen and the gastropexy had been performed 7 months prior. The authors concluded that t-fasteners with absorbable sutures should be preferred over nonabsorbable sutures. We did not identify any complications directly related to the retained t-fastener such as abscess or fistula, although, we analyzed a limited number based on availability of follow up CT imaging. In our study, only t-fasteners with absorbable sutures were utilized. Therefore, once the t-fastener suture has dissolved and absorbed, the t-fastener is a foreign body similar to a surgical clip.

This study is limited by its retrospective nature and lack of consistent CT follow-up after gastric access. Given the limitations of volume averaging and spatial resolution, the exact identification of the tissue plane of the t-fastener may not be completely accurate, particularly given the phenomenon of tenting of the pliable wall of the stomach. Furthermore, various operators apply varying levels of tension on the t-fastener when locking them into place, may favor t-fastener migration. Finally, we evaluated only one particular type of t-fastener. Given the varying thickness, lengths, and materials used for other types of t-fasteners, our results may not be completely generalizable to all types of t-fasteners.

In conclusion, our results demonstrate a substantial rate of t-fastener migration following deployment for gastropexy, mostly occurring within 4 weeks. Thus, on abdominal imaging studies, retained and migrated t-fasteners are relatively common finding. The majority of t-fasteners did not detach and pass through the gastrointestinal tract as intended, but we found no significant complications associated with retained or migrated t-fasteners. In contrast to prior reports stating that transgastric tube exchange or replacement can be safely performed early after insertion if t-fastener gastropexy was performed, our results suggest that the t-fasteners cannot be assumed to be in an intraluminal position to provide adequate gastropexy.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. Brown AS, Mueller PR, Ferrucci JT Jr. Controlled percutaneous gastrostomy: nylon T-fastener for fixation of the anterior gastric wall. Radiology 1986;158:543-545.
2. Timratana P, El-Hayek K, Shimizu H, Kroh M, Chand B. Percutaneous endoscopic gastrostomy (PEG) with T-fasteners obviates the need for emergent replacement after early tube dislodgement. Surg Endosc 2012;26:3541-3547.
3. Dewald CL, Hiette PO, Sewall LE, Fredenberg PG, Palestrant AM. Percutaneous gastrostomy and gastrojejunostomy with gastropexy: experience in 701 procedures. Radiology 1999;211:651-656.
4. Hashiba K, Fabbri CE, Cappellanes CA, Branco PD, Birolini D, Oliveira MR. Endoscopic percutaneous gastrostomy without laparotomy. Endoscopy 1984;16:219-222.
5. Mellinger JD, Simon IB, Schlechter B, Lash RH, Ponsky JL. Tract formation following percutaneous endoscopic gastrostomy in an animal model. Surg Endosc 1991;5:189-191.
6. Moote DJ, Ho CS, Felice V. Fluoroscopically guided percutaneous gastrostomy: is gastric fixation necessary? Can Assoc Radiol J 1991;42:113-118.
7. Maxwell CI, Hilden K, Glasgow RE, Ollerenshaw J, Carlisle JG, Fang JC. Evaluation of gastropexy and stoma tract maturation using a novel introducer kit for percutaneous gastrostomy in a porcine model. JPEN J Parenter Enteral Nutr 2011;35:630-635.
8. Thornton FJ, Fotheringham T, Haslam PJ, McGrath FP, Keeling F, Lee MJ. Percutaneous radiologic gastrostomy with and without T-fastener gastropexy: a randomized comparison study. Cardiovasc Intervent Radiol 2002;25:467-471.
9. Lorentzen T, Nolsøe CP, Adamsen S. Percutaneous radiologic gastrostomy with a simplified gastropexy technique under ultrasonographic and fluoroscopic guidance: experience in 154 patients. Acta Radiol 2007;48:13-19.
10. Covidien wound closure. Biosyn package insert [Internet]. Mansfield: Covidien; c2012 [cited 2013 Feb 18]. Available from: http://www.syneture.com.
11. Ho T, Margulies D. Pneumoperitoneum from an eroded T-fastener. Surg Endosc 1999;13:285-286.