

Long Term Outcomes Following Failure of Nissen Fundoplication

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Abstract

Purpose: To determine the management and outcomes of patients with gastro-oesophageal reflux (GOR) that require further intervention following failure of Nissen Fundoplication (NF).

Methods: After institutional audit department approval, a retrospective review of paediatric patients who had further intervention following failure of primary NF between January 2006 and December 2015 for GOR at our centre was performed. Data is presented as median (range).

Results: Of 820 patients who underwent NF, 190 (23%) received further procedures for GOR management at a median of 21 months of age (6-186); 90/190 (47%) had gastrojejunal feeding (GJ). Of these 67 (74%) remained on GJ feeds up to a median of 48 months and 23/90 (26%) had a second NF after GJ feeding. 97/190 (51%) had a redo fundoplication without having had a GJ; thus 120/190 (63%) of patients having a further procedure went on to have a second NF after a median period of 15 months (1-70 months). Three patients (2%) had early emergency wrap revision 4 days after first fundoplication (we classed this as an 'early complication'). Of the seven patients who failed a 3rd NF, 4 continued GJ feeding, 2 of had oesophogastric dissociation; 2 had 4th NF of which 1 was successful and 1 patient had gastric pacemaker and is successfully feeding orally. Patients who were finally successfully managed with GJ underwent 2 (2-5) tube changes/year. We found patients who had a previous GJ were more

likely to have failure of the redo fundoplication than those who had not to have the GJ (16/24 vs. 30/90, $p=0.005$).

Conclusion: The chance of success decreases with every further attempt at fundoplication. The only factor significantly associated with failure of redo fundoplication was whether the patient previously had a GJ tube. In patients with failed fundoplications, when symptom free on jejunal feedings, further anti-reflux surgical intervention should be avoided. A randomized prospective study is needed for patient selection.

Keywords:

Gastro-oesophageal reflux disease, Nissen fundoplication, redo fundoplication, gastro-jejunal feeding.

Introduction

Symptoms of gastro-oesophageal reflux disease (GORD) refractory to maximum medical treatment mandate antireflux surgery. A variety of techniques exist for the surgical management of GORD; fundoplication being the most common. Fundoplication prevents GOR by correcting hiatal herniation, lengthening the intraabdominal portion of the oesophagus, tightening the crura and increasing the pressure at the lower oesophageal sphincter. However, there exists a significant rate of failure with recurrence of symptoms. Options for the child with a failed fundoplication include medical management, jejunal feeding using a percutaneous tube or a Roux-en-Y jejunostomy, revision of the fundoplication, or oesophagogastric dissociation. The pooled rate of reoperation following failed fundoplication in children with neurological impairment being 15%, and 7% in children without neurological impairment [1]. Whilst jejunal feeding has been proved to be a reasonable alternative to redo fundoplication [2] with good nutritional outcomes, it has inherent morbidities such as the need for continuous feeding, tube dislodgement / blockage We reviewed our experience of such patients in the current study.

1. Methods

1.1. Study population

After registering this study with the Clinical Audit Department (hospital audit number 2075), a retrospective review of all children who underwent NF at our centre from January 2006 through December 2015 was performed. A previous study from our institution has previously reported on outcomes and risk factors for failure of redo fundoplication [3] and therefore this date range was selected to avoid double reporting of patient outcomes.

1.2 Data collection

Patient data were collected including age, gender, diagnoses, dates and type of surgical procedures, dates of insertions and changes of gastrojejunal tubes, long term outcomes at follow up visits including resolution / persistence of symptoms and complications such as chest infections. Interventions were defined as non-medicinal interventions, namely NF or GJ feeding. Success was defined as ‘no need for further intervention’. In those needing gastrojejunal (GJ) feeding, the tube was inserted through a pre-existing gastrostomy (PEG-J) or a gastrostomy was created percutaneously under radiologic guidance by the interventional radiologists.

1.3 Statistical analysis

Data were analysed and reported as medians or means with range or standard deviation for continuous variables and with frequency and percentages for categorical data. Factors (neurological impairment, oesophageal atresia, cardiac co-morbidity, syndromic status, age at redo fundoplication, interval between first and second fundoplication, GJ insertion before redo fundoplication) associated with failure of redo fundoplication were analysed by Cox regression analysis adjusting for length of follow-up time (IBM SPSS v26).

2. Results

A total of 820 patients were underwent NF. After the first NF, 630 patients did not receive further invasive anti-reflux procedures (A flow diagram of the procedures received is shown in Figure 1). 190/820 (23%) received further procedures for GOR management at a median of 21 months of age (6-186). 90/190 (47%) of patients having a further procedure following failure of the first fundoplication had a GJ (three had received a GJ before their first fundoplication); of these 67 (74%) remained on GJ feeds up to a median of 48 months and 23/90 (26%) had a second NF after GJ feeding. 97/190 (51%) had a redo fundoplication without having had a GJ, so that 120/190 (63%) of patients having a further procedure went on to have a second NF (115 laparoscopic and 8 open fundoplications) after a median period of 15 months (1-70 months). Three patients (2%) had early emergency wrap revision 4 days after first fundoplication, we classed this as an early complication rather than a redo fundoplication. None of these three patients had a further anti-reflux procedure.

A second NF was successful in 72/120 (60%) (median follow up of 53 months following redo fundoplication (1 - 140)). Further intervention for GOR was performed in 48/120 (40%) patients who had a redo fundoplication. Of these, 10/48 (21%) proceeded straight to a third NF, which was clinically successful in 8 (80%), and 38/48 (79%) were managed with GJ, which was successful in 33/38 (87%) (follow up of 20 months (18 - 30)). The 5/38 (13.5%) patients who were not successfully managed with GJ following a second NF had a third NF, which was successful in 2/5 (40%). Median interval between second and third NF was 19 months (15 – 48).

Of those seven patients who failed a third fundoplication, two had a fourth fundoplication, which was successful in 1, whereas the other had a further GJ. In the other five patients who failed their third fundoplication, 2 had total oesophogastric dissociation followed by jejunal feeding (1 jejunostomy, 1 GJ), 1 patient had a gastric pacemaker and is successfully feeding orally, and the other two continued on jejunal feeds. Overall, the likelihood of successful fundoplication diminish from first fundoplication to third (Figure 2).

Patients who were finally successfully managed with GJ underwent 2 (2-5) tube changes/year. Other than the GJ tube dislodgements found in 34% of the patients, there were no major complications associated with GJ change.

We explored factors associated with failure of redo fundoplication. Neither neurological impairment, previous oesophageal atresia repair [4], cardiac co-morbidity, syndromic status, age at redo fundoplication nor interval between first and second fundoplication were significantly associated with failure of redo fundoplication. The only factor significantly associated with failure of redo fundoplication was whether the patient had previously had a GJ tube (either before first fundoplication or between first and second fundoplication; [Figure 3; hazard ratio for failure if GJ performed before redo fundoplication 0.33 95% CI [0.18-0.61], $p < 0.0005$. Patients who had a previous GJ were more likely than those who had not to have a failure of the redo fundoplication (16/24 vs. 30/90, $p = 0.005$).]

3. Discussion

Fundoplication is currently practised as the operation of choice for treating GORD where medical treatment has been unsuccessful. However, literature is replete with evidence of recurrence of GORD following fundoplication [1,3,4,5,7,9,15,16]. Our previous published studies by Kimber and Spitz et al [5] found redo fundoplication failed to resolve the preoperative symptoms in 20%, with 5/66 children requiring a third fundoplication. In the subsequent series (1994–2005) of patients undergoing fundoplications Pacilli et al [3] found open surgery at the first fundoplication ($p = 0.011$) and neurological impairment (NI) ($p = 0.046$) as the risk factors for failure. In our current series, 42% patients were NI who received further intervention after the second fundoplication. The higher incidence of failure in NI patients is believed to be multifactorial; with retching as the most common associated symptom [6]. A multicentre study reported by Baerg et al [7] found retching before the initial fundoplication to be independently associated with redo fundoplication. Persistent retching might itself lead to wrap disruption due to an increased pressure on the wrap [5, 6]; 3 of our patients needed wrap revision as early as 4 days after fundoplication. Retching is associated with disturbed gastric electrical control activity and may be related to vagal nerve dysfunction following Nissen fundoplication [8].

The option of percutaneous gastrojejunostomy (GJ) is relatively less invasive, requires lesser recovery time, and can be removed if symptoms of gastroesophageal reflux improve [9]. Also, feeding into the jejunum can help prepare the child nutritionally in the interim before the subsequent fundoplication. Our previous series [2] which showed stable nutritional outcomes in jejunally fed patients; in our current cohort of patients, the median increase in weight in those who had the second fundoplication with interim GJ feeds after the failed first fundoplication was 5 kg. This was more than those done without the interim NJ feeds (3.75 kg). Although the difference is marginal, it can be relevant in individual cases.

Despite these advantages, a GJ tube feeding can be problematic and cause complications [10]. It necessitates a continuous feeding regimen, requires additional procedures if the tube becomes dislodged as was required in 34% of our cases. Secondly, with each event of change of the jejunal tube exposes the patient to a dose of radiation. The median radiation dose–area product for a change of GJ tube was found to be 7 $\mu\text{Gy}\cdot\text{m}^2$ in our previous series [2]. However, in literature, there is no clear consensus regarding the additional cumulative lifetime risk of radiation to patients. No other complications reported with GJ tubes such as bowel perforation, intussusception, intestinal obstruction [11] were found in our patients. In keeping with a more conservative treatment to GORD, a very recent study from North America has reported that the volume for fundoplication in children with GORD has seen a 3-fold decrease over the last decade. [12]

When one or more fundoplications have failed, the complication profile of a GJ tube may compare more favourably to a redo fundoplication [9]. The chance of success is likely to decrease with every further attempt of fundoplication especially in neurologically impaired children who are more susceptible to post-operative complications [13]. In view of paucity of randomised studies [14,15,16] on long term outcomes of anti-reflux interventions, it is important to explain the pros and cons to the family on individual case by case basis.

One patient in this study underwent total oesophago-gastric disconnection (TOGD) with Roux-en Y jejunostomy after failure of initial fundoplications. Although preferred as the operation of choice in some centres [17,18] for severely neurologically impaired children with the inability to swallow which

is often due to pharyngeal neuromuscular incoordination, we believe that it can be too major an operation for these children. First proposed by Bianchi [19] in 1997 as a salvage operation after failed fundoplication, nonetheless it may be helpful in these select group of patients [9]

Although 5 patients in our study died, none of them were operative deaths or due to complications directly related to GORD or its management. It is similar to as was found in Livingstons et al [20] systematic review and meta -analysis of management of GORD by fundoplication or gastro-jejunal feeding that the majority of the deaths were due to the underlying condition or co-morbidities or unknown causes.

This study is limited by the fact that it is retrospective in nature. However, an attempt to minimise selection bias has been made by including all patients in whom fundoplication was performed during a defined time period. In this series, success was defined as improvement of symptoms following surgery; a subjective assessment made by the treating surgeon(s). We believe using validated carer questionnaire survey “quality of life” [21] would probably provide a more robust outcome measure for future prospective studies.

4. Conclusion

Failure to manage symptoms of GOR following initial fundoplication is challenging. Although redo fundoplication may be indicated due to factors such as anatomical disruption / wrap migration the chance of success decreases with every further attempt at fundoplication. If the patient progressively stabilises with jejunal feeding, we recommend continuing maintaining on GJ feeding and avoid further surgical intervention. However, this being a retrospective study with its inherent limitations, a randomised and prospective studies will be more helpful in optimising patient selection.

Conflict of interest:

None

Funding:

P.D.C. is supported by National Institute for Health Research (NIHR-RP-2014-04-046). All research at Great Ormond Street Hospital NHS Foundation Trust and UCL Great Ormond Street Institute of Child Health is made possible by the NIHR Great Ormond Street Hospital Biomedical Research Centre. The views expressed are those of the author (s) and not necessarily those of the NHS, the NIHR or the Department of Health.

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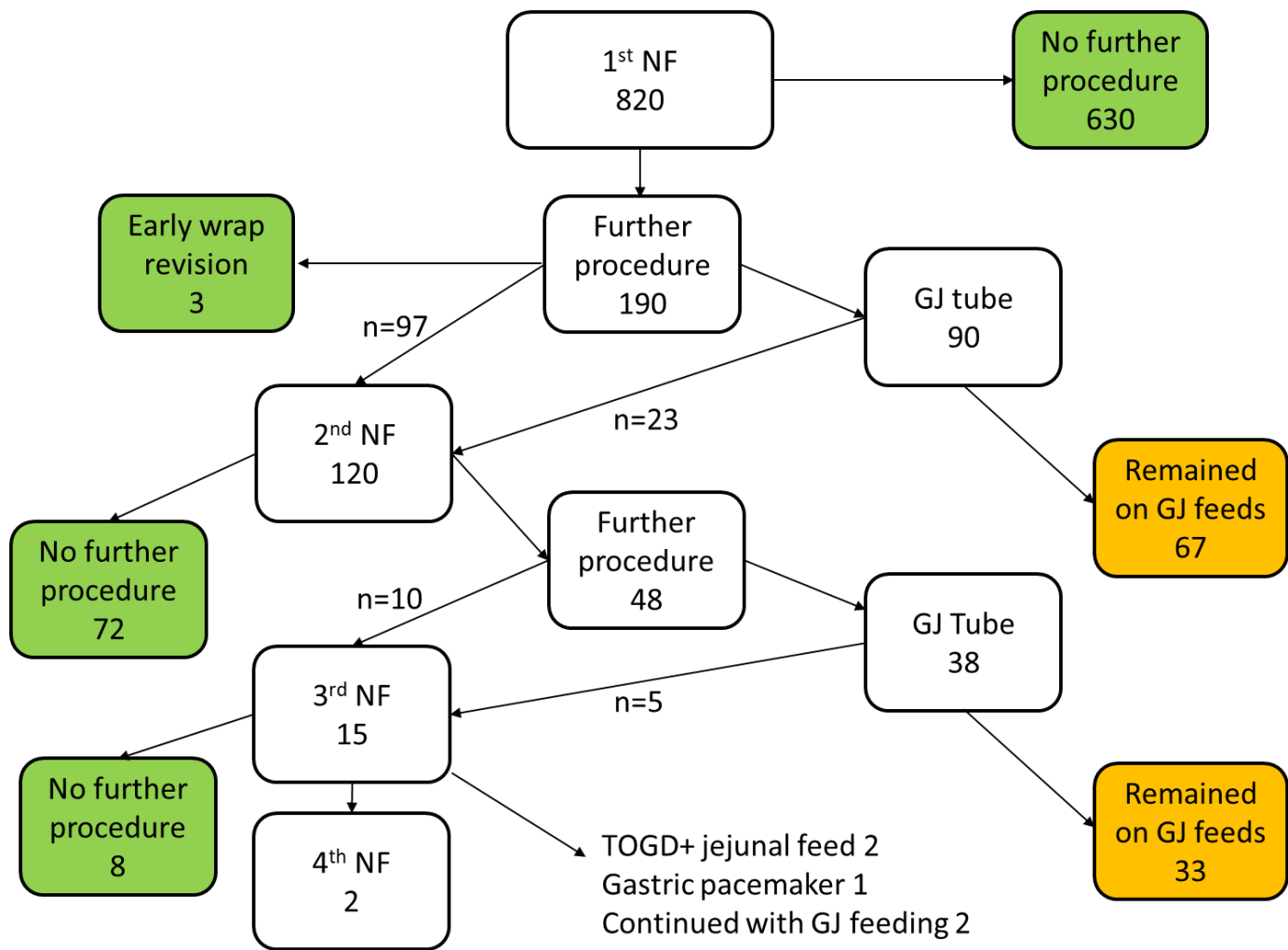


Figure 1

Flow diagram showing procedures received following fundoplication.

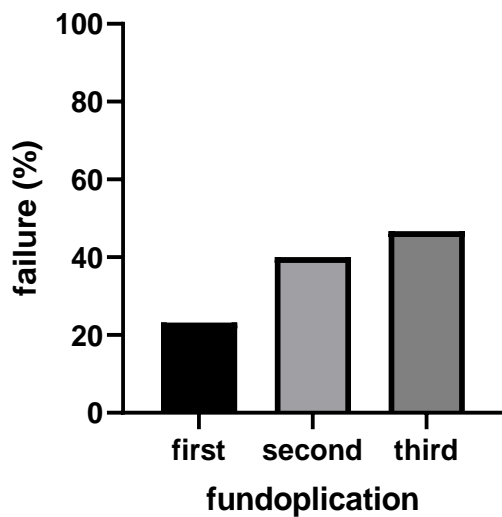


Figure 2. Failure rate following fundoplication.

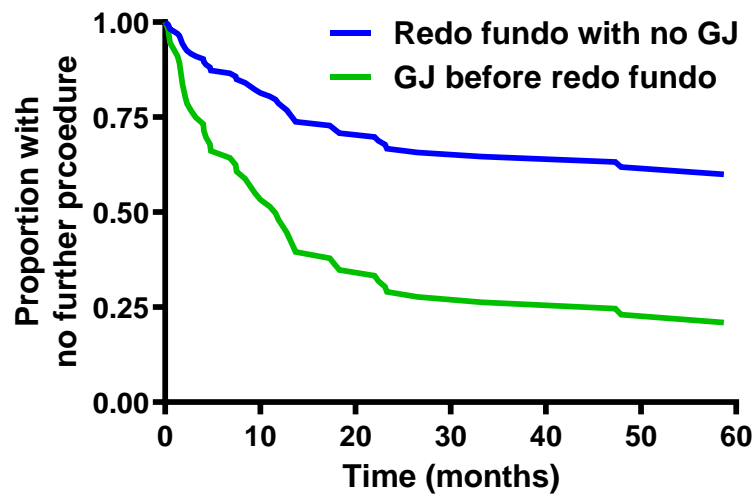


Figure 3. Failure rate over time following redo fundoplication. Analysed by Cox regression, taking into account cardiac comorbidity, neurological impairment and GJ before redo fundoplication. Hazard ratio for failure if GJ performed before redo fundoplication 0.33 95% CI (0.18-0.61), $p < 0.0005$.