

1Keywords: Transnasal oesophagoscopy, Transnasal endoscopy, Transoral endoscopy,  
2Diagnostic and Therapeutic endoscopy, Unsedated endoscopy, Head and Neck Cancer,  
3Dysphagia, Dysphonia

4

5Keypoints

- 6 • Implementing a one-stop Transnasal oesophagoscopy (TNO) service will benefit  
7 patients, clinicians as well as the NHS Trusts.
- 8 • TNO is safe, well-tolerated and improves diagnostic and therapeutic precision in the  
9 upper aerodigestive tract and oesophagus.
- 10 • The one-stop TNO service has clear financial benefits.
- 11 • The one-stop TNO service is a streamlined pathway which improves patient care and  
12 experience.
- 13 • Both the clinical and financial risk of introducing the service is low.

14

## 15 **Introduction**

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17We share our experience creating a business case for establishing a transnasal  
18oesophagoscopy (TNO) service. Our aim is for interested ENT units to consider the impact  
19and adoption of a highly effective diagnostic service improving the assessment of patients  
20with dysphagia, dysphonia or tumours, which traditionally require radiological imaging,  
21general anaesthesia (GA) endoscopy and multiple appointments.

22

23An estimated 45% of the general population suffer with symptoms resembling globus  
24pharyngeus at some point in their life [1]. The most common endoscopic procedure in the UK  
25is an upper gastrointestinal (GI) endoscopy, performed over 800,000 times in 2019 [2].  
26Endoscopic services met 73.7% of their urgent cancer wait targets, 68.7% of routine targets  
27and 63.4% of surveillance targets [2]. With a near 10% increase in the number of endoscopies  
28performed between 2017 and 2019, the adoption of a one-stop TNO clinic under ENT could  
29help improve treatment targets and offers numerous additional benefits [2].

30

31Whilst the one-stop TNO service is not a new model, only 26,000 TNOs were carried out in  
32the NHS in 2019 [2]. This may be due to the lack of the required training and the awareness  
33of its potential advantages. Currently, only a few hospitals in the UK offer a TNO service. In

34our London Trust, a TNO service is provided both by the Gastroenterology and ENT  
35departments.

36

### 37One-stop Transnasal Oesophagoscopy (TNO) Service

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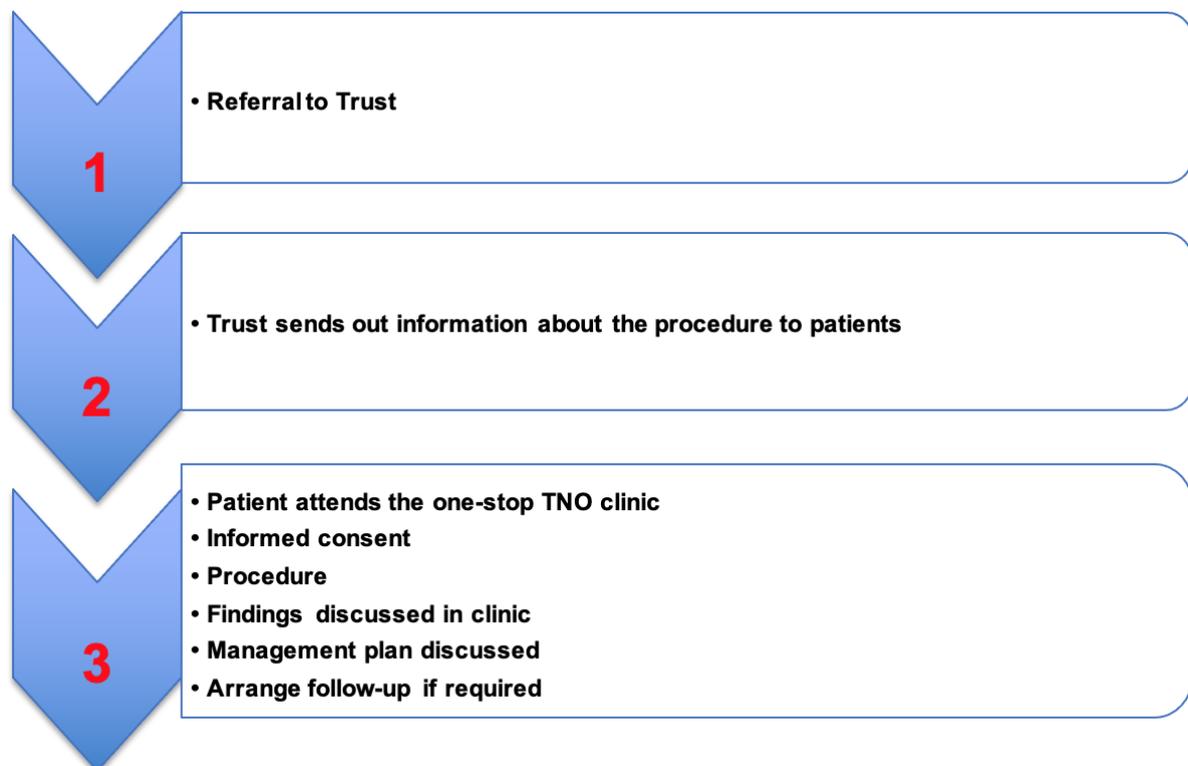
39A one-stop TNO service allows immediate examination and treatment of the upper  
40aerodigestive tract (See **Appendix A**). It is safe and improves diagnostic and biopsy precision  
41in the upper aerodigestive tract and oesophagus [3]. TNO can be performed in the outpatient  
42setting, is relatively easy to perform, and is well tolerated by patients under topical local  
43anaesthetic alone [1, 3]. The ability to examine, biopsy, and perform therapeutic procedures  
44in the same visit, facilitates a streamlined one-stop service.

45

46The ideal pathway of this service (See **Figure 1**) is direct referral from the general  
47practitioner (GP) or hospital physician to an outpatient one-stop clinic where diagnostic tests  
48and treatment are provided. This allows patients to immediately discuss their results and  
49return home the same day.

50

51



**Figure 1: One-stop Transnasal Oesophagoscopy Service Pathway**

## 53Method

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## 55Ethical Considerations

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57This is a business service model registered as a service evaluation and audit hence ethical  
58approval is not required.

59

## 60Project Operations and Management

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### 62Personnel

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64The minimum staff requirement is one trained personnel (consultant/surgeon/operator) and 2  
65trained assistants (nurses). An additional nurse is required to monitor the patient in the  
66recovery room for an hour following the procedure prior to discharge. In our department, the  
67service is effectively run with a trained consultant, a trainee and 3 trained nurses.

68

### 69Equipment

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71Several companies manufacture transnasal oesophagoscopes, including PENTAX, Olympus,  
72XION, DP Medical and KARL STORZ. Our unit uses the PENTAX EG16-K10 scope due to  
73the 3-in-1 capabilities to assess, investigate and treat voice, airway and swallowing disorders  
74both in clinic and theatre. Depending on the model, TNOs can be single-use or reusable with  
75decontamination. See **Table 1** for our equipment checklist and **Figure 2** for our set up.

76

<i>For TNO Assessment</i>	<ul style="list-style-type: none"><li>• Transnasal oesophagoscope – 1 per patient</li><li>• Videostack system</li><li>• 5% lidocaine hydrochloride + 0.5% phenylephrine hydrochloride – 2 per patient</li><li>• Instillagel – 2% Lidocaine gel – 1 per patient</li><li>• Xylocaine – 10% Lidocaine – 1 per patient</li><li>• Pack of Gauze</li><li>• Personal Protection Equipment</li></ul>
<i>Additional For Vocal Cord Injection Procedures</i>	<ul style="list-style-type: none"><li>• Voice injection (Botox®, RENÚ® VOICE, Hyaluronic acid, Depomedrone steroid) – 2 per</li></ul>

	<ul style="list-style-type: none"> <li>patient</li> <li>Rigid injection needle with support cannula – 1 per patient</li> <li>Hypodermic needle size 24G x 1.5” – 1 per patient</li> <li>1 cup non-sterile hot water</li> <li>MADgic™ Atomisation Device (Teleflex, USA) – 1 per patient</li> </ul>
<i>Additional For Biopsy Procedures</i>	<ul style="list-style-type: none"> <li>Specimen pot</li> <li>Flexible forceps</li> <li>MADgic™ Atomisation Device (Teleflex, USA) – 1 per patient</li> </ul>
<i>Additional For Balloon Dilation Procedures</i>	<ul style="list-style-type: none"> <li>Cook® medical balloon – 3 selection of sizes (sizes 20, 18, 15) per patient</li> <li>Cook® medical syringe 60mls – 1 per patient</li> </ul>
<i>Additional For Blue/KTP Fibre or CO<sub>2</sub> Laser Procedures</i>	<ul style="list-style-type: none"> <li>Blue laser</li> <li>Specimen pot</li> <li>Flexible forceps</li> <li>Additional personal protection equipment – laser eyewear, door signs and locks on doors</li> </ul>

77Table 1: Our equipment checklist for TNO procedures

78



**Figure 2: Example of an outpatient set up**

## 80 Procedure

81

82 Adequate topical application of local anaesthesia is paramount to a comfortable and effective  
83 TNO. We favour two sprays of lidocaine hydrochloride (5%)/phenylephrine hydrochloride  
84 (0.5%) in each nasal cavity, 3ml of lidocaine gel (2% lidocaine) to the anterior nares and two  
85 sprays of lidocaine (10%) to the oral cavity and oropharynx. 5mls of lidocaine gel is used to  
86 lubricate the oesophagoscope.

87

88 Depending on the procedure, the laryngeal anaesthesia can be achieved by application of  
89 2mls of 4% or 10% lidocaine, via an epidural catheter through the instrument channel or via a  
90 MADgic™ device transorally under endoscopic guidance.

91 With adequate topical anaesthesia achieved, the transnasal oesophagoscopes is passed  
92 transnasally, facilitating assessment of the entire upper aerodigestive tract. The patient is  
93 instructed to swallow the scope to pass into the hypopharynx, along the oesophagus and  
94 through the gastro-oesophageal junction (GOJ) into the stomach.

95 A therapeutic procedure or biopsy can be performed concurrently depending on findings,  
96 with patients subsequently monitored in a recovery room for 1 hour prior to discharge.  
97 Virtual or face-to-face follow up (if required) averages 2-4 weeks post-procedure.

98 Promotion of the service

99

100 Patients will be selected from primary and secondary care referrals. Patients will be advised  
101 that they may be undergoing TNO by their referrer or by the booking administrators  
102 following referral triage.

103

104 **Results**

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106 **Performance and Activity**

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108 The performance of the service is evaluated through these performance indicators: patient  
109 waiting times, length of procedure (TNO assessment takes 5-10 minutes and an additional 20  
110 minutes for therapeutic procedures), readmission or ‘failed day-case discharge’ rates, adverse  
111 incidents, and complaints in relation to service provision and financial reimbursement.

112

113 In our service the 10 item Eating Assessment Tool (EAT-10) and Voice Handicap Index  
114 (VHI-10) is performed pre-treatment and is reassessed on follow-up to assess treatment  
115 response. In addition, a patient satisfaction survey, including discomfort and pain scores of  
116 the nose and throat, is used to monitor patient reported outcomes.

117

118 **Discussion**

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120 **Benefits Appraisal**

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<i>Clinicians</i>	<i>NHS Trusts</i>	<i>Patients</i>
Comprehensive ENT examination from nasal cavity to GOJ	Switch from inpatient setting to outpatient one-stop clinic setting thereby reducing the patients’ length of hospital stay	Reduces the time to diagnosis and treatment improving continuity of patient care and experience

<p>Digital High-Resolution imaging increasing diagnostic yield and biopsy precision</p>	<p>Reduces waiting lists in day surgery, main theatre, barium swallows and radiology where these spaces can be assigned to other uses</p>	<p>Early and more accurate diagnosis means better outcomes</p>
<p>Eliminates risks associated with GA, particularly valuable in high risk patients</p>	<p>Shorter procedure time and more cost beneficial to the Trust</p>	<p>Immediate results remove stress of waiting and the need for additional travel for result clinics</p>
<p>Equipment is user friendly</p>	<p>Eliminates need for bed spaces</p>	<p>Outpatient setting less daunting to patients than theatre</p>
<p>Can be performed in outpatient setting so there is no need for theatre preparations</p>	<p>Saving theatre resources for other procedures</p>	<p>Avoidance of GA often means less risks and quicker recovery</p>
	<p>Reduce need for outpatient results clinic visits due to instant results</p>	<p>Reduces time spent in the hospital, minimising risk of hospital acquired infection</p>

122**Table 2: Summary of the key benefits of a one-stop TNO service to clinicians, NHS**  
123**Trusts and patients [3-5]**

124

125**Limitations**

126

127Limitations of TNO include extensive nasal pretreatment, potential nasal pain or discomfort  
128and the need for specialist training for involved personnel [5]. There is a higher insertion  
129failure rate compared to transoral endoscopy under GA and the narrow working channel can  
130sometimes limit functionality [5]. TNO may not be successful in patients with significant  
131nasal obstruction. The most common complication of TNO is self-resolving epistaxis,  
132occurring in less than 5% of cases [4, 5]. Other rare complications include infection,  
133vasovagal syncope, laryngospasm, recurrent or residual symptoms and failure to penetrate the  
134oesophagus past the cricopharyngeus muscle especially in pharyngeal pouch. A rare but  
135major complication is oesophageal perforation (1%-3%) which necessitates hospital  
136admission, keeping the patient 'nil by mouth', and inserting a nasogastric tube for feeding  
137until the perforation closes, confirmed with water-soluble contrast swallow [6]. Significant  
138complications should be covered in an emergency escalation protocol (See **Appendix B**).

139

140**Financial Analysis**

141

142A clinical cost analysis of TNO was performed by Wellenstein *et al.* with secondary costs  
143such as patient travel and workdays missed excluded [7]. The study concluded that the  
144average difference in costs was £83.77 (€94.43) per procedure, with average costs of £472.64  
145for TNO and £556.40 (€627.23) for theatre-based procedure [7]. Furthermore, by eliminating  
146theatre use and 1 day ward administration, a one-stop TNO service saves on average £812.57  
147(€916.00) per case [7]. At our Trust, the average tariff for a one-stop TNO and balloon  
148dilation procedure is £654.60 and the average tariff for TNO and Blue Laser is £1418.6. This  
149compares favourably to the national average tariff for therapeutic endoscopic upper  
150gastrointestinal tract at £512 [8]. Our estimated installation cost was £120,000 (excluding  
151VAT) for a TNO stack, 4 TNO scopes and the (KayPENTAX) system computer.

152

153**Risk Analysis**

154

155Clinical

156

157There is a low level of clinical risk around adoption of a TNO service as several clinical  
158studies have demonstrated TNO to be safe, well-tolerated, and effective [3-5].

159

160Contraindications of TNO are few, but include haemodynamic instability, bleeding diathesis  
161or severe coagulopathy, and significant nasal surgery. In these limited instances alternative  
162investigations or treatments e.g. expectant management, medication or examination under  
163GA should be offered. Complications are rare and, in most cases, transient.

164

### 165Financial

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167There is a low level of financial risk to the Trust as a TNO service reduces the risk of the  
168Trust breaching the NHS targets and reduces fines. Another possible financial threat is in the  
169funding to purchase the equipment. In the case where Trust funds are not sufficient, different  
170purchasing options are available and external grants could also be an additional source of  
171funding.

172

### 173Covid-19

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175In keeping with current local guidelines to mitigate the risk of Covid-19 during the pandemic,  
176the patients are needed to isolate for a 2-week period before the procedure and are required to  
177have a negative Covid-19 test 3 days before the procedure. This policy is continuously  
178reviewed to remain in line with national and local guidance. In the current context clinic  
179based protective measures include routine use of PAPR hoods, full length gown and gloves,  
180and HEPA air filtration unit (Filtrex) (See **Figure 2**).

181

### 182Patient

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184A potential risk to a new service is the initial limited capacity (i.e. due to the number of  
185clinicians able to perform the procedure) resulting in the service being overwhelmed resulting  
186in delays in care. Referrals should be triaged with a proportion of patients referred to existing  
187services for the initial stages until the one-stop TNO service achieves full capacity.

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### 189Personnel

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191There is a risk of insufficient staff as the adoption of this system would require additional  
192staff and there is a need for staff training.

193

### 194Conclusion

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196Our experience outlines the setup of a one-stop TNO service, highlighting the rationale,  
197practicalities, and the relevant financial aspects justifying its adoption. This redesigned  
198service improves patients experience, offers clear financial benefits, and can help Trusts meet  
199NHS treatment targets. The risk both clinically and financially in introducing the service is  
200low. With its numerous outlined benefits, the authors advocate the systematic establishment  
201and dissemination of a Nationally standardised one-stop TNO service across the NHS.

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241

242 **Figure/Table Legends**

243

244 Figure 10 One-stop Transnasal Oesophagoscopy Service Pathway

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246 Figure 2: Example of an outpatient set up

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248 Table 1 Our equipment checklist for TNO procedures

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250 Table 2: Summary of the key benefits of a one-stop TNO service to clinicians, NHS trusts  
251 and patients [3-5]

252