

# UK 1st National Health Service (NHS) EndoBarrier (EB) Service: Outcomes in 1st 38 Patients to Reach 6 Months after Device Explant

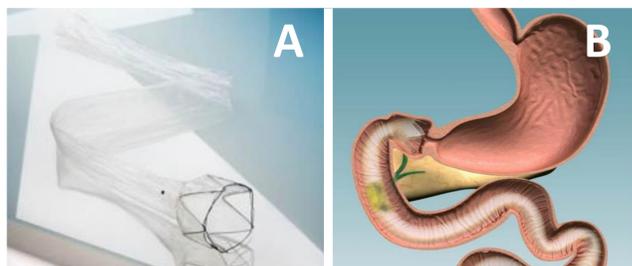
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## ABSTRACT

EB, a 60cm endoscopically implanted proximal intestinal liner, reduces weight and HbA1c over 1 year. In the 1st NHS EB service, we provided EB for patients with sub optimally controlled diabetes and monitored outcomes in a registry. The 1st 38 patients have completed 6 months post EB removal and of these 31/38 (82%) (age 51.4 ± 6.8 yr, 51.6% male, diabetes duration 12 (6-21) yr) attended follow up. During EB implant, mean ± SD HbA1c fell by 2.5 ± 2.0 %, from 10.0 ± 2.0 to 7.5 ± 1.2 % (p<0.001), weight by 15.8 ± 9.0 kg from 120.6 ± 27.6 to 104.9 ± 28.9 kg (<0.001), systolic BP from 138.3 ± 15.6 to 123.0 ± 14.6 mmHg (<0.001), serum alanine-aminotransferase (ALT - marker of liver fat) from 29.7 ± 17.6 to 19.6 ± 11.5 U/L (p<0.001). Median (IQR) total daily insulin dose reduced from 102 (48-129) to 25 (0-59) units (p<0.001), n=20. 6 months post EB explant 21/31 (68%) had maintained the improvement and this was reflected in the figures for the group as a whole (table 3). 7/20 (35%) insulin treated patients discontinued insulin. Of the 10 whose weight and/or HbA1c deteriorated, 7/10(75%) had depression. 4/38 (10.5%) patients had early EndoBarrier-removal: 3 GI bleed, 1 liver abscess. All 4 had full recovery after removal. All other patients achieved a full year of EB treatment. Our data demonstrates EB as highly effective in patients with refractory diabetes, with maintenance of improvement after removal in 68%.

## BACKGROUND

Our institution led a UK, multicentre, randomised controlled trial (REVISE-Diabetesy ISRCTN00151053) investigating the interaction of Endobarrier therapy, a 60cm endoscopically implanted proximal intestinal liner, with glucagon-like peptide-1 drug therapy. The Endobarrier is implanted by endoscopy for up to 1 year before endoscopic removal.



**Figure 1: 1A.** Photograph of Endobarrier with crown anchor in foreground and tubing posteriorly; **1B** shows the device implanted in the proximal intestine with ingested food (yellow) passing within the device.

## AIM

To evaluate whether acquired experience could translate into establishment of an NHS Endobarrier (EB) Service in patients with diabetes that:

1. Is effective during the device implant
2. Maintains effect 6-months after removal
3. Is safe and well tolerated

## METHOD

- i) We initiated an NHS EndoBarrier service for patients with suboptimally controlled type 2 diabetes and obesity, involving:
  - design of a comprehensive 2-year patient pathway
  - consultation with relevant teams and patients
  - management support
  - funding system agreed with local service commissioners
- ii) We primed patients to maintain improvements after, by suggesting **institution of behaviour changes** during Endobarrier.
- iii) We established a **secure online registry** supported by ABCD to monitor outcomes
- iv) We implanted 62 EndoBarriers since October 2014

## RESULTS

**Table 1:** So far 38/62 patients completed 6 months post EB; 31/38 (82%) attended follow up. Baseline characteristics, n=31:

Parameter	N=31
Age (years)	51.4±6.8
Sex (% male)	51.6
Ethnicity (% Europid)	45.2
BMI (kg/m <sup>2</sup> )	41.9±8.5
HbA1c (mmol/mol)	85.7±22.2
HbA1c (%)	10.0±2.0
*Diabetes duration (years)	12.0(6-21)
Taking insulin (%)	64.5

**Table 2:** Outcomes at explant of EndoBarrier; n=31

Parameter	Baseline	EB Explant	Difference	P-value
Weight (kg)	120.0±27.6	104.9±28.9	-15.8±9.0	<0.001
BMI (kg/m <sup>2</sup> )	41.9±8.5	36.3±8.8	-5.6±3.3	<0.001
HbA1c (mmol/mol)	85.7±22.2	58.8±13.4	-26.9±22.1	<0.001
HbA1c (%)	10.0±2.0	7.5±1.2	-2.5±2.0	<0.001
Systolic blood pressure (mmHg)	138.3±15.6	123.0±14.6	-14.3±17.0	<0.001
ALT (U/l)	29.7±17.6	19.6±11.5	-10.1±16.5	0.002
Insulin daily dose* (n=20)	102(48-129)	25(0-59)	-77	<0.001

\* Median(IQR). 6 of the 20 (30%) patients discontinued insulin

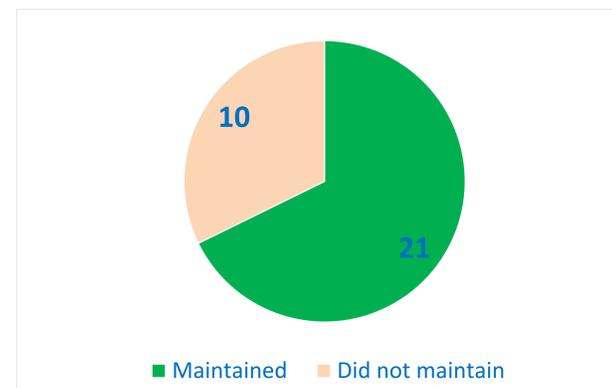
**Table 3:** Outcomes 6 months after Endobarrier explant; n=31

Parameter	Baseline	6m post EB	Difference	P-value
Weight (kg)	120.0±27.6	109.8±30.6	-10.8±10.2	<0.001
BMI (kg/m <sup>2</sup> )	41.9±8.5	38.0±8.8	-4.0±3.7	<0.001
HbA1c (mmol/mol)	85.7±22.2	65.6±18.4	-20.1±22.2	<0.001
HbA1c (%)	10.0±2.0	8.2±1.7	-1.8±2.0	<0.001
Systolic blood pressure (mmHg)	138.3±15.6	133.0±13.5	-5.3±16.5	0.084
ALT (U/l)	29.7±17.6	20.6±10.7	-9.1±16.0	0.003
Insulin daily dose* (n=20)	102(48-129)	24(0-54)	-78	<0.001

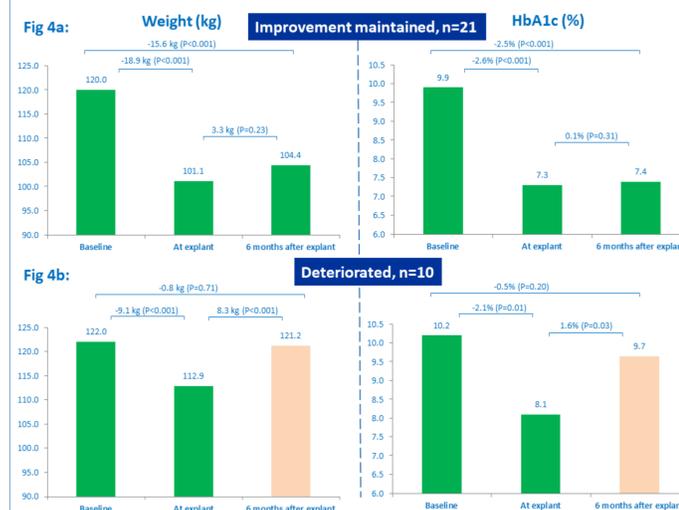
\*Median(IQR). 7 of the 20 (35%) patients discontinued insulin

The deterioration in mean weight and HbA1c between explant (Table 2) and 6 months after explant (Table 3) was caused by 10/31 (22%) patients who deteriorated whilst 21/31 (68%) patients maintained the improvements sustained during the period of up to 1 year with EndoBarrier (Figures 3 and 4).

**Figure 3:** 21/31 (68%) of the patients had maintained the treatment effect at 6 months post explant



**Figure 4:** The weight and HbA1c at baseline, at explant and 6 months after explant in the 21/31 (68%) who maintained the improvement (Fig 4a) and 10/31 (22%) who deteriorated (Fig 4b).



It can be seen (Figure 4) that the patients who went on to deteriorate had had less fall in weight and HbA1c during the period of EndoBarrier treatment than those who maintained:

**Table 4:** Weight loss and HbA1c fall at explant in those who maintained and those who deteriorated:

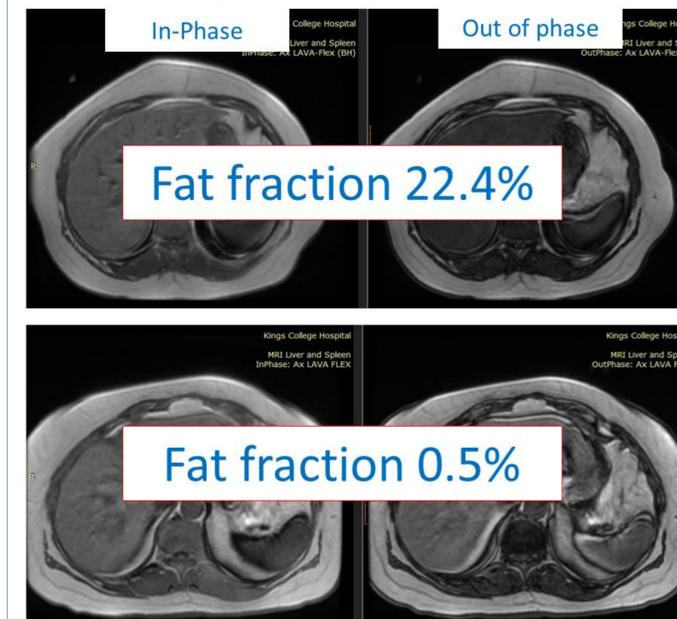
	Weight loss during EndoBarrier treatment	Fall in HbA1c during EndoBarrier treatment
Maintained (n=21)	18.9 kg	2.8%
Deteriorated (n=10)	9.1 kg	2.1%

By way of explanation, those who deteriorated reported to us many problems in their lives and 7/10 (70%) had depression.

## Liver fat

The reduction in ALT (Table 2) is likely to reflect reduction in liver fat as we have previously demonstrated occurs with EB (Figure 5).

**Figure 5:** Liver fat pre- and 4-month post EndoBarrier-MR images. From the REVISE-Diabetesy study with EndoBarrier. Data presented at DDW 2016, San Diego USA, May 2016



## Early removal of EndoBarrier

4/38 (10.5%) patients had early EB removal: 3 GI bleed, 1 liver abscess.

- One GI bleed **could have been averted**: the patient reverted to normal food during 2nd week after insertion instead of recommended pureed food
- A second GI bleed **could have been averted**: the patient stopped taking recommended proton pump inhibitor after 10 weeks. Nevertheless he lost 9.6 kg, HbA1c fell from 12.1% to 6.5% and his insulin requirement fell from 140 to 30 units daily
- The other GI bleed patient lost 8.2 kg during 2 months
- The liver abscess case lost 18.4 kg during 7 months before Endobarrier removal
- All patients made a full recovery

## Friends and Family Test

93.8% of our patients stated that they would be extremely likely to recommend our service to friends and family.

## CONCLUSION

Our data demonstrate Endobarrier as highly effective in patients with refractory diabetes. Maintenance of improvement after EndoBarrier removal was achieved in 68%. There were high patient satisfaction levels and an acceptable safety profile. As endoscopy units are ubiquitous, our service could be readily disseminated. Hepatic Abscess is a known risk as a result of EndoBarrier treatment. Clinicians should be vigilant for this complication but if it occurs the device can, if necessary, be removed. These data are supportive of risk:benefit being strongly towards benefit and they support the continuance of EndoBarrier as an important treatment option for refractory diabetes.