



Cornthwaite, K., Jefferys, A., Lenguerrand, E., Haase, A., Lynch, M., Johnson, A., ... Siassakos, D. (2016). Pregnancy after weight loss surgery: A commentary. *BJOG: An International Journal of Obstetrics and Gynaecology*, 123(2), 165-170. DOI: 10.1111/1471-0528.13791

Peer reviewed version

Link to published version (if available):

[10.1111/1471-0528.13791](https://doi.org/10.1111/1471-0528.13791)

[Link to publication record in Explore Bristol Research](#)

PDF-document

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1 **Pregnancy after weight loss surgery: A commentary**

2

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28 The obesity epidemic poses increasing challenges to maternity services across the
29 UK and the world; almost one fifth of women of childbearing age in the UK are
30 classified obese (BMI \geq 30) ¹. Optimisation of pre-pregnancy weight can improve
31 maternal and perinatal outcomes and greater numbers are resorting to bariatric
32 surgery pre-pregnancy to aid weight loss. Whilst the negative impact of obesity on
33 maternal and perinatal health is well-established ², there is a dearth of evidence
34 evaluating the effect of previous bariatric surgery on pregnancy. Given the likelihood
35 of rising rates of pregnancies following bariatric surgery, it is essential that both
36 patients and clinicians have evidence-based information to inform care. However, as
37 yet, there are very few robust clinical trials that have directly assessed pregnancy
38 outcomes following bariatric surgery. Consequently, the majority of our
39 understanding comes from case reports and observational studies (Table 1). This
40 commentary reviews recent and emerging evidence for the management of women
41 who are pregnant after bariatric surgery.

42

43 'Bariatric surgery' is an umbrella term that encompasses several different types of
44 weight loss procedures. In the UK, the most commonly performed procedures are
45 Laparoscopic Adjustable Gastric Banding (LAGB), Roux-en-Y gastric bypass, and
46 sleeve gastrectomy ³ (Table 2). Broadly, bariatric procedures can be categorised as
47 malabsorptive, restrictive or a combination of both. Malabsorptive procedures bypass
48 an absorptive part of the gastrointestinal tract, whereas restrictive procedures reduce
49 food intake by limiting gastric volume. Each type of bariatric surgery has specific
50 procedure related metabolic effects and complications. Nutritional deficiencies are
51 more likely after malabsorptive surgery ⁴. It is axiomatic that each method will have
52 specific effects on pregnancy, maternal outcomes and perinatal health.

53

54 Therefore it is unhelpful that most published studies group all bariatric procedures
55 together as a single intervention. There are other problems with the existing data too:

56 understandably for a previously uncommon intervention many studies to date have
57 necessarily small sample sizes. To improve statistical power a great deal of the
58 research has taken place over a protracted number of years, which makes firm
59 conclusions difficult as there are likely to have been temporal changes in clinical
60 practice and policy. Moreover, many studies have not accounted for important
61 confounders. Finally, there is often a lack of adjustment for socio-demographics
62 factors such as smoking, parity, and age. Other studies have compared outcomes in
63 the same woman in pregnancies before and after bariatric surgery. This approach
64 does not completely disentangle the impact of weight loss per se, from the complex
65 effects of bariatric surgery and is also prone to confounding.

66

67 However, some broad conclusions can be drawn from the available data: after
68 bariatric surgery ⁴⁻⁶ there is reduction in obesity-related maternal complications such
69 as gestational diabetes and hypertension. However, the risk remains higher than for
70 non-obese women⁷.

71

72 Improvements in some maternal outcomes notwithstanding, there have been
73 concerns raised regarding the negative impact of bariatric surgery on perinatal
74 outcomes, including small for gestational age infants and pre-term birth ^{4,8}. There has
75 also been a suggestion of an increased risk of perinatal mortality ⁶. Moreover, very
76 few studies have exclusively explored the impact of gastric banding on pregnancy,
77 and there has been no randomized controlled trial comparing the management
78 (deflation versus inflation) of the gastric band in pregnancy ⁹.

79

80 In addition to general risks, there are other specific complications including maternal
81 intestinal hernias and nutritional deficiencies, as well as a greater risk of birth defects
82 amongst pregnancies following gastric bypass surgery ⁴.

83

84 We recently completed a national cohort study of Laparoscopic Adjustable Gastric
85 Banding (LAGB) in pregnancy ^{10, 11} to understand the procedure related impact of
86 LAGB on pregnancy outcomes. This study is currently awaiting publication. Data
87 were collected on all pregnancies following LAGB in the UK over a discrete time
88 period using an established surveillance system (UK Obstetric Surveillance System –
89 UKOSS). Uniquely, the study compared outcomes according to index band
90 management (maintenance of band inflation during pregnancy versus band deflation
91 for some or all of pregnancy) and adjusted for important confounding or modifying
92 factors. Outcomes were compared with controls without a gastric band, and national
93 data, allowing comparison with the background population.

94

95 The study ^{10, 11} identified significant variation in band management across the UK,
96 possibly related to the current paucity of evidence to inform decision-making for
97 these women during pregnancy. In this cohort study, inflation of the gastric band was
98 related to a reduction in gestational weight gain, and an associated improvement of
99 some maternal outcomes.

100

101 However, our findings suggest that these maternal benefits may be at the expense of
102 perinatal health. Moreover, some maternal outcomes such as gestational diabetes
103 and caesarean birth were consistently worse in those with a gastric band compared
104 to normal BMI controls, regardless of band management.

105

106 On the basis of our findings, we would not recommend a one-size-fits-all policy
107 during pregnancy, but band adjustments should be made on a case-by-case basis.
108 Irrespective of the band management, pregnancies after bariatric surgery remain
109 high risk and it is essential that women are closely monitored. A multi-professional
110 approach with close involvement of endocrinologists and nutritionists, monitoring of

111 gestational complications such as diabetes and hypertension, as well as regular fetal
112 growth scans are recommended.

113

114 However, clinical judgment alone should not dictate management. It is important for
115 professionals to involve women in decision-making, enabling them to remain in
116 control of their pregnancy and thereby optimising pregnancy and birth experience ¹².

117 A woman's preference regarding band management is likely to be multifactorial.

118 Decision-making may not rest solely on the balance of the maternal and perinatal
119 outcomes, but may have a more complex psychological element. Obesity has been
120 associated with high rates of depression and poor body image, and bariatric surgery
121 can lead to improvements in mental health ¹³. However, it is unclear how pregnancy
122 may influence the psychological wellbeing and mood of women with a gastric band,
123 and what psychosocial support, if any, these women may require during pregnancy.

124 The ENGAGE (ENquiry into women with GAstric banding in pregnancy to Guide
125 management and improve Experience) study aims to explore women's experience of
126 pregnancy following LAGB and assess which factors drive a woman's decision
127 regarding management of the band during pregnancy ¹⁴. Most women interviewed
128 thus far had their bands inserted in the private sector. Preliminary analysis suggests
129 limited information, guidance and support in pregnancy, and need for clarity
130 regarding band management during pregnancy.

131

132 A national prospective cohort study, using the same UKOSS methodology, is
133 currently ongoing to better understand the effects of gastric bypass surgery on
134 pregnancy ¹⁵. All women who are pregnant following gastric bypass surgery are
135 included. Epidemiology, management and outcomes, will be evaluated to assess
136 current practice. The findings will help to inform obstetricians, endocrinologists,
137 nutritionists, and bariatric surgeons for pre-pregnancy counseling, suitable monitoring
138 and appropriate nutritional supplementation.

139

140 Furthermore, there is a paucity of data regarding how long to delay pregnancy
141 following weight loss surgery. American guidelines recommend a surgery to
142 conception interval of at least one year ¹⁶ however, there is no firm evidence to
143 support such advice ¹⁷. Data from the UKOSS gastric banding and bypass studies
144 are currently being analysed to investigate the impact of time to conception on
145 maternal and fetal outcomes; the results will be informative.

146

147 In conclusion, the rates of bariatric surgery in women are likely to increase further,
148 but there are very few data available to guide clinicians. Much of the evidence is from
149 registry-based studies and case reports. Furthermore, there has been a tendency to
150 group all bariatric procedures together in studies evaluating associated pregnancy
151 outcomes, despite clear mechanistic differences as well as different procedure-
152 related effects on pregnancy. However, there is emerging evidence that will inform
153 both the understanding of different types of bariatric surgery, and the effect of
154 management options on patient outcome and experience.

155

156 In the meantime, we would advocate multi-professional care for all women who have
157 undergone bariatric surgery (Table 3). Ideally, these women should receive pre-
158 pregnancy counseling; until further advice is available, we would suggest that women
159 delay pregnancy for one year following surgery. Women should be screened and
160 treated for nutritional deficiencies prior to conception ¹⁸ and receive prompt specialist
161 dietary advice during early pregnancy. They should be advised about the associated
162 maternal and fetal risks antenatally. We would recommend low dose aspirin and
163 vitamin supplementation; close blood pressure and urinalysis surveillance; and
164 universal testing of gestational diabetes. Importantly, fetal wellbeing should be
165 carefully monitored with serial growth scans. Clinicians may consider the role of

166 induction at term to reduce the risk of placental dysfunction and intrauterine fetal
167 death.

168

169 Clearly, the findings from ongoing studies will refine these recommendations and
170 provide the clarity clinicians need, and women want, to make appropriate decisions
171 together.

172

173 Insert Table 3

174

175 **Acknowledgements**

176 None

177 **Disclosure of Interests**

178 None

179 **Contribution to Authorship**

180 Katie Cornthwaite conceived the idea, wrote the manuscript, is principal investigator
181 of UKOSS gastric bypass study, and co-investigator of UKOSS gastric banding and
182 ENGAGE studies.

183 Amanda Jefferys edited the manuscript and is principal investigator of UKOSS
184 gastric banding and ENGAGE studies.

185 Erik Lenguerrand edited the manuscript and conducted the UKOSS gastric banding
186 analyses.

187 Anne Haase edited the manuscript and is co-investigator of ENGAGE study.

188 Mary Lynch edited the manuscript and is co-investigator of ENGAGE study.

189 Andrew Johnson provided funding for the two UKOSS studies and approved the
190 manuscript.

191 Tim Draycott edited and approved the manuscript.

192 Dimitrios Siassakos conceived the idea, co-wrote and edited the manuscript, and
193 supervises the UKOSS gastric bypass, gastric banding and ENGAGE studies.

194 **Ethics Approval**

195 Data for UKOSS gastric banding (NRES 11/SW/0227), UKOSS gastric bypass
196 (NRES 14/LO/0491), and ENGAGE studies (13/SW/0285) were collected with ethics
197 approval

198 **Funding**

199 Bristol Bariatric Pregnancy Research Hub
200 North Bristol Trust Springboard Fund

201

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