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Systematic Review and Meta-Analysis of Perinatal Outcome After Gastric Banding vs. Gastric Sleeve

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Abstract

Background: Obesity is a widespread health issue caused by a combination of genetic and environmental factors. The prevalence of obesity is increasing globally, including in Belgium. Bariatric surgery is often used as a treatment option for patients with higher classes of obesity. However, there is a growing population of women who have undergone bariatric surgery and are either planning to become pregnant or are already pregnant. This population poses unique challenges and requires further research to guide their management during pregnancy. There are two main groups of bariatric surgery, malabsorptive and restrictive. This systematic review and meta-analysis aimed to compare perinatal outcomes, specifically birth weight, preterm birth, and early and late pre-eclampsia, between different types of restrictive procedures, namely gastric sleeve and gastric banding.

Methods: English or Dutch language articles were identified in a Medline, Embase, and Cochrane Library search without publication date restriction using the keywords for pregnancy and bariatric surgery or gastric sleeve or gastric banding. A total of 16 studies were included in the review, consisting of case-control studies, cohort studies, reviews, and guidelines. Meta-analysis was performed using a random effects model.

Results: The meta-analysis of four studies revealed that gastric banding was associated with a reduced risk of having a Small for Gestational Age (SGA) baby compared to obese women without bariatric surgery. Similarly, the odds of having a Large For Gestational Age (LGA) infant were lower after gastric banding. However, these findings were not statistically significant. Gastric banding did show a significant reduction in the risk of developing gestational hypertension and pre-eclampsia compared to obese women. The meta-analysis showed no statistically significant difference in the risk of preterm delivery between gastric banding and obesity.

Conclusion: The results suggest that gastric banding may have beneficial effects on perinatal outcomes, including a reduced risk of SGA, LGA, gestational hypertension, and pre-eclampsia. It is recommended that restrictive bariatric surgery be considered in women of reproductive age to minimize pregnancy complications. The current evidence does not allow us to compare the differences in perinatal outcomes between gastric banding and sleeve gastrectomy. Most of the research has been done on gastric banding, and there is little evidence about perinatal outcomes after sleeve gastrectomy. More trials are needed to compare the effects of sleeve gastrectomy and gastric banding on pregnancy outcomes.

Keywords: Obesity; Bariatric surgery; Pregnancy; Complications; Genetics; Patients

Introduction

Obesity is a condition in which fat accumulates in the body to such an extent that it can damage health. The causes are often a combination of genetic predisposition and environmental factors (e.g., lifestyle). Occasionally, obesity is caused by a specific condition, such as hormonal abnormalities (e.g., reduced thyroid function) or a genetic disorder [1].

In Western Europe, 54% of the population is overweight (BMI ≥ 25 kg/m²), and 19% is obese (BMI ≥ 30 kg/m²; on average, 20% of women and 19% of men) [2]. Table 1 shows an overview of the BMI classification. Obesity is a global problem and is still on the rise, even in countries that historically had a low prevalence. Obesity is also becoming more prevalent in Belgium. Belgian figures from Sciensano for 2018 show that 49.3% of adults are overweight (BMI ≥ 25 kg/m²). 15.9% are obese (BMI ≥ 30 kg/m²) [3].

Group	BMI (kg/m²)
Normal weight	18.5-24.9
Overweight	25-29.9
Obesity class I	30-34.9
Obesity class II	35-39.9
Obesity class III	≥ 40

Table 1: Classification of BMI.

While the first step in the treatment of BMI ≥ 25 kg/m² consists of lifestyle modification, we often see that this is insufficient in patients with higher classes of obesity. Therefore, treatment through bariatric surgery is increasingly used in eligible patients (BMI ≥ 35 kg/m² -39.9 kg/m² with comorbidities or BMI ≥ 40 kg/m²).

On average, 13,407 patients undergo bariatric surgery in Belgium each year. The vast majority, namely 73.72% of these, are women [4]. Most women who undergo bariatric surgery are of childbearing age. We notice an increasing number of patients who have undergone bariatric surgery and want to become pregnant or are already pregnant. As a result of their subsequent weight loss, there is a reduced risk of various

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complications such as gestational diabetes, hypertensive disorders, macrosomia, a trend towards fewer cesarean sections, and a general health improvement with a reduction of comorbidities [5]. Despite this, this specific population continues to be characterized by its own profile of complications and points for attention. Given that there are still many unanswered questions regarding the guidance of this patient population during pregnancy and the lack of clarity in the literature, further research may be necessary.

Bariatric surgery procedures

In Belgium, the Roux-en-Y gastric bypass (63%) and the gastric sleeve (or sleeve gastrectomy) (35%) are mainly performed. The use of gastric banding (or gastric ring or gastric band) is declining rapidly. Currently, it is only used in 1.3% of cases in Belgium [1]. Figures 1a-1c shows an overview of the different types of bariatric procedures.

The most important bariatric procedures today are:

- Roux-en-Y bypass (RYGB) is a mixed procedure that restricts food intake by creating a small stomach pouch and connecting it directly to the small intestine. Due to the reduction of the stomach, less intake is possible, and due to the bypass of part of the small intestine, fewer nutrients and calories are absorbed. In theory, this procedure is reversible, but in practice, this is much more difficult than with a gastric band.

- The sleeve gastrectomy or Gastric Sleeve (SG) is being performed more frequently, in some countries, even more than a gastric bypass. It is a restrictive intervention, reducing the stomach size by about 70% to 80%. Only enough stomach is left for a tube or sleeve-shaped connection (sleeve) between the esophagus and the small intestine so that the patient can eat less. It also leads to a decrease in the ghrelin hormone, which reduces appetite. The procedure does not directly influence the absorption of calories and nutrients in the body. It is not reversible in itself, but it can still be converted to another type of procedure.

- The Laparoscopic Adjustable Gastric Band (LAGB) is a purely restrictive procedure. Around the upper part of the stomach, an inflatable band is placed. This creates a stomach pouch, which allows the patient to eat smaller amounts. Again, there is no limitation in the absorption of calories and nutrients in the body. The LAGB was performed very often until about 5 years-10 years ago. It is a relatively non-invasive and reversible surgical intervention with a low risk of complications during or shortly after surgery. However, it turned out to provide less weight loss than a gastric bypass or a gastric sleeve. In addition, it appeared to cause many intolerance problems and/or complications in the medium and long term (such as band shifting or band erosion).

Objectives

This study aims to determine whether there is a difference in perinatal outcomes (namely birth weight, preterm delivery, and early and late pre-eclampsia) after gastric sleeve versus gastric banding.

Materials and Methods

A systematic review and meta-analysis were performed. Several different databases were reviewed. The databases that were used are Medline, Embase, and Cochrane Library. The search strategy included a mixture of keywords and MeSH headings: (gastric sleeve or gastric banding) and (pregnancy or pregnant). There was no limitation on the publication date. The literature search was completed in April 2023. Only studies in Dutch or English were included. We included randomized, quasi-randomized trials, and non-randomized studies. We included studies that combined all types of bariatric surgery or provided data for LAGB or SG separately. The following perinatal outcomes were included: preterm delivery, SGA, LGA, and pre-eclampsia. Additional articles were collected by crossreferencing from articles identified by our search.

The search strategy included the following PICO: P; Pregnant women who have had gastric sleeve or gastric banding surgery before their pregnancy; I: Gastric banding; C; Gastric sleeve or gastrectomy; O;Perinatal outcomes:

- Neonatal; Birth weight below P10 (Small for gestational age, SGA), birth weight above P90 (Large for gestational age, LGA), preterm delivery (<37 weeks).
- Maternal; Early versus late pre-eclampsia.

One reviewer performed the data extraction. First, a literature review took place, in which appropriate studies that met the inclusion criteria were selected. Subsequently, the titles and abstracts were screened to identify potentially relevant citations. Finally, the full text of all potentially relevant articles was acquired and read. A prisma flow chart was used to track these steps (Figure 2) [6,7]. Of the 161 studies screened, 16 were included. Of the studies included, 4 were case-control studies, 5 were cohort studies, 6 were reviews, and 1 guideline.

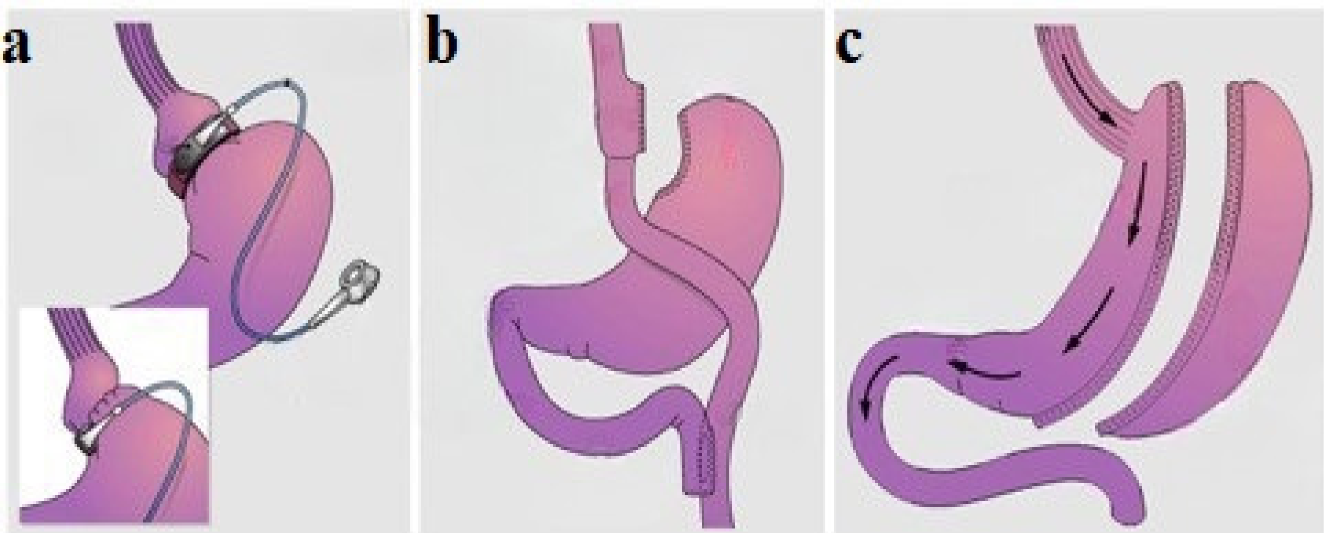

Figure 1: Overview of types of bariatric surgery, adapted from Cornthwaite, et al. [6], a) Gastric banding, b) Roux-en-Y-Bypass, c) Sleeve gastrectomy.

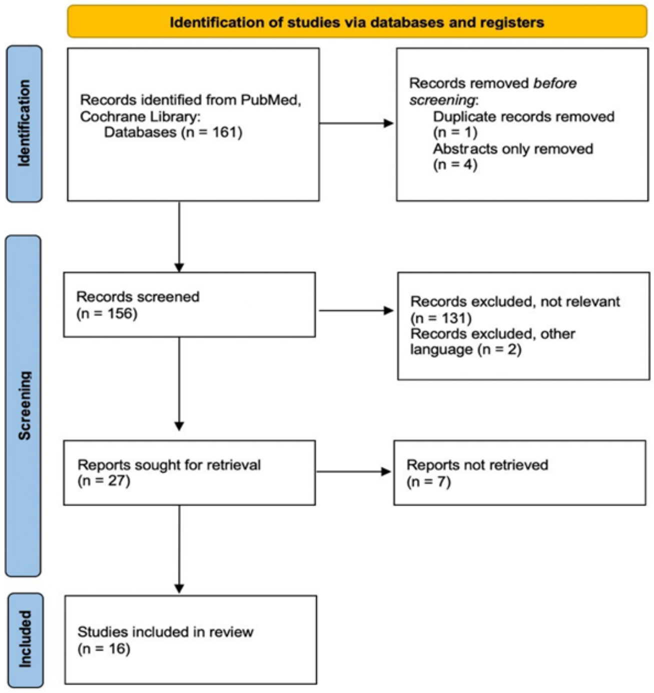

Figure 2: PRISMA flow chart [7].

The protocol for this systematic review was published in PROSPERO (ID CRD42023421195).

Quality assessment

The quality of the selected articles was evaluated by one author using the Newcastle-Ottawa quality assessment scale. Studies that achieved eight or more stars, from a maximum of 10 stars, were considered high quality [8].

Analysis

As expected, the studies included in this review were very diverse regarding study design, study quality, description of screening methods, interventions, and outcomes. The different articles were qualitatively described using narrative synthesis. Text and tables were used to descriptively summarise and explain the different study characteristics and findings (Tables 2-4).

Meta-analysis

Four studies were eligible for meta-analysis. Study characteristics were extracted, including study design, type of bariatric surgery, and control group. Incidences, effect sizes, and Confidence Intervals (CI) of adverse perinatal outcomes were also extracted. Meta-analysis was used to calculate a pooled Odds Ratio (OR) and 95% CI. A random effects model was used to calculate the ORs. This assumes a variation between studies; therefore, a calculated OR has a more conservative value. Heterogeneity was assessed by graphical exploration with forest plots. All analyses were performed using SPSS statistics.

Results

Birth weight

Our meta-analysis of the four trials that reported on gastric banding compared with an obese control group showed that the pooled Odds Ratio for having an SGA baby was 0.59, with a p-value of 0.29. This shows a reduction in the risk of having a baby with SGA after gastric banding compared with the obese control group (Figure 3 and Table 5).

Our meta-analysis of the four trials showed that the pooled Odds Ratio for having an LGA infant was 0.66, with a p-value of 0.07. This shows a reduction in the odds of having an LGA baby after gastric banding compared to the control group of obese women (Figure 4 and Table 6).

Pre-eclampsia

In our meta-analysis, we made a subdivision for gestational hypertension and pre-eclampsia. The results for gestational hypertension showed that the pooled Odds Ratio was 0.40, with a p-value of 0.02. This indicates that the risk of developing gestational hypertension is reduced after gastric banding compared with obese women. This is statistically significant (Figure 5 and Table 7).

The meta-analysis showed that the pooled Odds Ratio for having pre-eclampsia was 0.36, with a p-value of 0.04. This means there is a reduction in the risk of developing pre-eclampsia after gastric banding compared with the control group of obese women. This is statistically significant (Figure 6 and Table 8).

Preterm delivery

Our meta-analysis showed that the pooled Odds Ratio for preterm birth was 0.92, with a p-value of 0.77. This means that the risk of preterm birth is reduced after gastric banding compared with obese women. However, this is not a statistically significant difference (Figure 7 and Table 9).

Summary according to procedure type

The risk for a pregnancy complication is expected to be influenced by the procedure of bariatric surgery. We had no data to conduct a meta-analysis between sleeve gastrectomy and gastric banding. However, we could present the pooled incidences of perinatal outcomes divided into sleeve gastrectomy and gastric banding (Table 10).

Reference	Type of surgery	Study population, pre-pregnancy age (y) and BMI (kg/m2)	Controls	Significant difference compared with control group	No difference compared with control group	Authors conclusion
Dixon, et al. [9]	Banding	79 women, age 29.9 ± 4.7, no BMI available	1) Pre-LAGB pregnancies 2) Obese matched controls	-	Birthweight	Pregnancy risk after LAGB is comparable to risk of general public
Ducarme, et al. [10]	Banding	13 women, age 31.5 ± 5.7, BMI 34.8 ± 3.2	414 women, age 31.0 ± 6.0, BMI 35.8 ± 4.0	-	Labor induction, PIH, pregnancy duration, post-partum hemorrhage	Risk for obstetric complications is reduced in women after LAGB compared with women without LAGB
Chevrot, et al. [11]	Banding/Sleeve/ Bypass	139 women, age 31 ± 4.9, BMI 34.1 ± 6.0	139 women, age 32.4 ± 5.0, BMI 41.5 ± 1.7	Decreased rate of gestational diabetes and large for gestational age. Increased rate of small for gestational age (only with bypass)	-	Malabsorptive bariatric surgery was associated with an increased risk of fetal growth restriction.
Watanabe, et al. [12]	Banding/Sleeve/ Bypass	Banding: 6 women, age 28, BMI 31.2	Sleeve: 5 women, age 35, BMI 24.8. Bypass: 13 women, age 30, BMI 42	Decrease in birth weight between banding and bypass	-	Maternal anemia after malabsorptive surgery may lead to low neonatal birth weight, which could be attributed to the large-scale reduction in maternal micronutrient levels.

Table 2: Overview of case-control studies.

Reference	Type of surgery	Study population, pre-pregnancy age (y) and BMI (kg/m2)	PET	SGA (<p10)	LGA (>p90)	Preterm delivery (<37 w)
Sheiner, et al. [13]	Bypass/Banding	Only Banding: 202 pregnancies, age 31.7 ± 4.7, BMI 31.9 ± 6.2	6.9%	9.4%	4.5%	9.9%
Lapolla, et al. [14]	Banding	83 pregnancies, age 31.4 ± 4.6, BMI 35.0 ± 7.3	12%	1.4%	17.6%	17.6%
Carelli, et al. [15]	Banding	121 pregnancies, age 32.69 ± 3.86, BMI 32.7 ± 7.53	5%	8%	7%	6%
Coupaye, et al. [16]	Bypass/Sleeve	Only Sleeve: 46 pregnancies, age 31.1 ± 4.8, BMI 31.6 ± 6.8	0%	19%	9%	5%
Cornthwaite, et al. [6]	Bypass	290 pregnancies, age 32.9 ± 5.2, BMI 34.5 ± 7.0	-	-	-	-
Cornthwaite, et al. [6]	Banding	107 pregnancies, age 31.8 ± 4.9, BMI 36.4 ± 7.3	2.8%	7%	21%	13%
Cornthwaite, et al. [6]	Sleeve	29 pregnancies, age 34.2 ± 5.8, BMI 32.0 ± 5.3	0%	3%	3%	14%

Table 3: Overview of cohort studies.

Reference	Type of surgery	PET	SGA (<p10)	LGA (>p90)	Preterm delivery (<37 w)
Guelinckx, et al. [17]	Not specified	Decrease in the risk of pre-eclampsia after bariatric surgery	Increased risk for Intra-Uterine Growth Restriction (IUGR) and SGA	Decrease in mean birthweight after surgery-induced weight loss compared with pre-operative pregnancies	No difference
Magdaleno, et al. [18]	Not specified	Lower rates of hypertensive disorders after bariatric surgery	Increase in SGA (mainly after malabsorptive bariatric surgery)	Decrease in macrosomia	NA
Vrebosch, et al. [19]	Gastric banding	The incidence of pre-eclampsia is lower in gastric banding pregnancies than in non-gastric banding pregnancies in obese women, but higher than in average-weight women without gastric banding	The incidence of low birth weight is lower in gastric banding pregnancies than in non-gastric banding pregnancies in obese women	Decrease in macrosomia in comparison to non-gastric banding pregnancies in obese women	The rate of preterm deliveries was higher in the gastric banding group than in the average-weight group without gastric banding
Dalfra, et al. [20]	Malabsorptive vs restrictive bariatric surgery	The incidence of pre-eclampsia in pregnancies after bariatric surgery is lower than in pregnancies in obese women but higher than in average-weight women without previous bariatric surgery	More SGA	Decrease in macrosomia	More preterm births with gastric bypass than gastric banding
Galazis, et al. [21]	Not specified	Lower incidence of pre-eclampsia compared with controls	Higher incidence of small neonates compared with controls	Lower incidence of large neonates compared with controls	Higher incidence of preterm birth compared with controls
Akther, et al. [22]	Not specified	NA	Higher incidence of small neonates after malabsorptive surgeries, not after restrictive surgeries	Lower incidence of large neonates after malabsorptive surgeries, not after restrictive surgeries	Increase in preterm birth

Table 4: Overview of review studies.

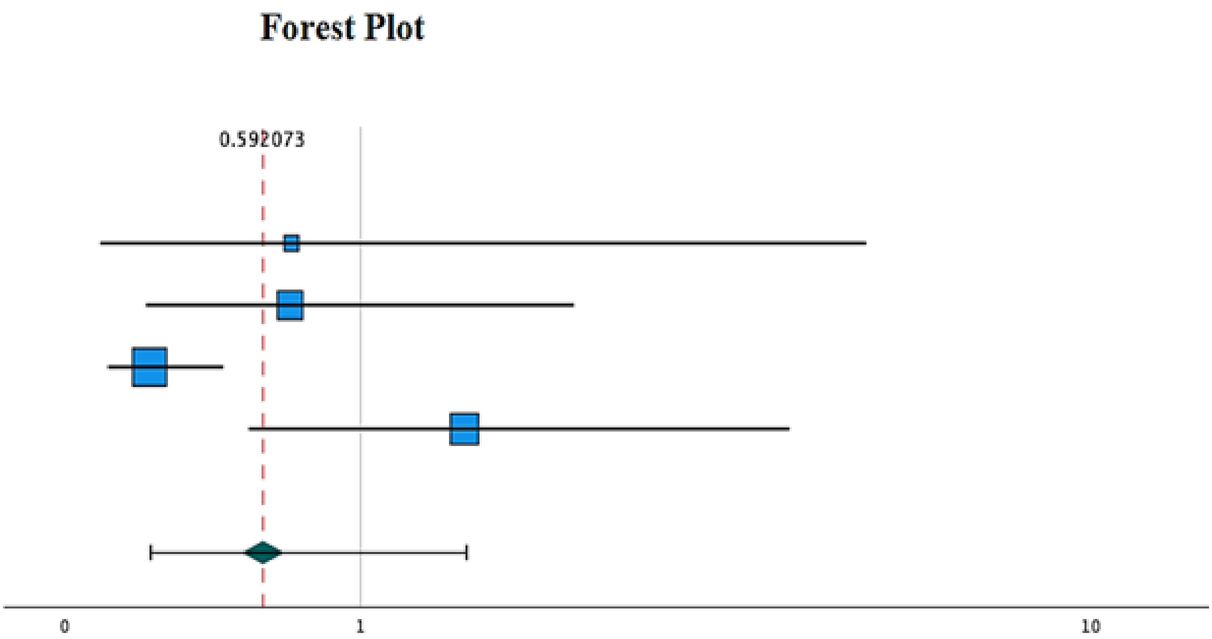

Figure 3: Forest plot of incidence of SGA after gastric banding versus obese women. **Note:** ( ) Effect size of each study; ( ) Estimated overall effect size; ( ) No-effect value; ( ) Confidence interval of effect size; ( ) Overall effect size value; ( ) Estimated overall confidence interval; Model: Random-effects model; Heterogeneity: Tau-squared=0.60, H-squared=2.89, I-squared=0.65; Homogeneity: Q=9.81; df=3, p-value=0.02; Axis is shown using log scale.

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ID	Study	OR	p-value	Weight	Weight (%)
1.00	Ducarme, et al. [10]	0.70	0.74	0.58	14.28
2.00	Dixon, et al.[9]	0.69	0.55	1.03	25.10
3.00	Lapolla, et al. [14]	0.22	0.00	1.36	33.25
4.00	Chevrot, et al. [11]	1.55	0.42	1.12	27.38
Overall		0.59	0.29	-	-

Table 5: Study related to incidence of SGA after gastric banding versus obese women.

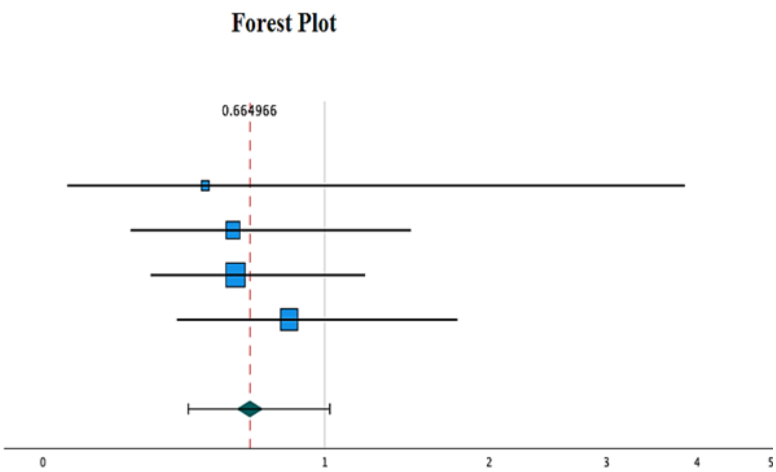

Figure 4: Forest plot of incidence of LGA after gastric banding versus obese women. **Note:** ( ) Effect size of each study; ( ) Estimated overall effect size; ( ) No-effect value; ( ) Confidence interval of effect size; ( ) Overall effect size value; ( ) Estimated overall confidence interval; Model: Random-effects model; Heterogeneity: Tau-squared=0.00, H-squared=1.00, I-squared=0.00; Homogeneity: Q=0.55; df=3, p-value=0.91; Axis is shown using log scale.

ID	Study	OR	p-value	Weight	Weight (%)
1.00	Ducarme, et al. [10]	0.49	0.50	0.91	4.44
2.00	Dixon, et al. [9]	0.60	0.26	4.71	23.06
3.00	Lapolla, et al. [14]	0.61	0.16	8.07	39.47
4.00	Chevrot, et al. [11]	0.83	0.64	6.75	33.03
Overall		0.66	0.07	-	-

Table 6: Study related to incidence of LGA after gastric banding versus obese women.

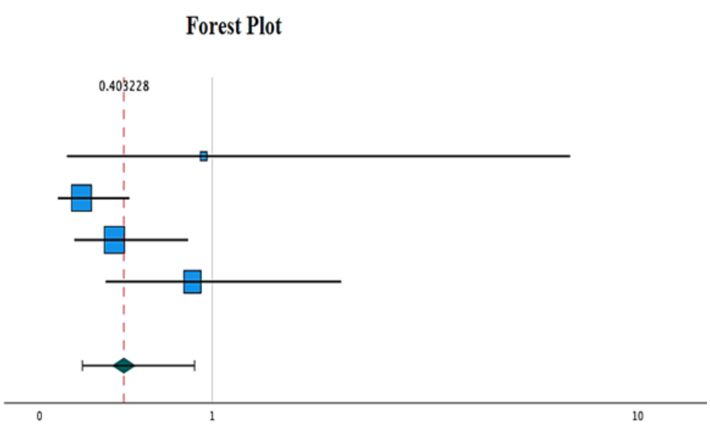

Figure 5: Forest plot of incidence of gestational hypertension after gastric banding versus obese women. **Note:** ( ) Effect size of each study; ( ) Estimated overall effect size; ( ) No-effect value; ( ) Confidence interval of effect size; ( ) Overall effect size value; ( ) Estimated overall confidence interval; Model: Random-effects model; Heterogeneity: Tau-squared=0.29, H-squared=2.02, I-squared=0.51; Homogeneity: Q=5.84; df=3, p-value=0.12; Axis is shown using log scale.

ID	Study	OR	p-value	Weight	Weight (%)
1.00	Ducarme, et al. [10]	0.93	0.95	0.71	10.69
2.00	Dixon, et al. [9]	0.18	0.00	2.06	31.04
3.00	Lapolla, et al. [14]	0.35	0.01	2.10	31.55
4.00	Chevrot, et al. [11]	0.85	0.75	1.78	26.72
Overall		0.40	0.02	-	-

Table 7: Study related to incidence of gestational hypertension after gastric banding versus obese women.

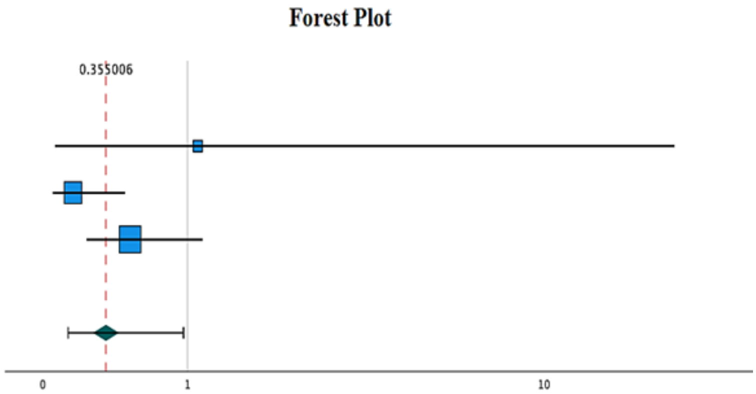

Figure 6: Forest plot of incidence of pre-eclampsia after gastric banding versus obese women. **Note:**( ) Effect size of each study; ( ) Estimated overall effect size; ( ) No-effect value; ( ) Confidence interval of effect size; ( ) Overall effect size value; ( ) Estimated overall confidence interval; Model: Random-effects model; Heterogeneity: Tau-squared=0.34, H-squared=1.81, I-squared=0.45; Homogeneity: Q=3.48; df=2, p-value=0.18; Axis is shown using log scale.

ID	Study	OR	p-value	Weight	Weight (%)
1.00	Ducarme, et al. [10]	1.10	0.95	0.40	10.39
2.00	Dixon, et al. [9]	0.16	0.00	1.49	38.50
3.00	Lapolla, et al. [14]	0.52	0.11	1.97	51.11
Overall		0.36	0.04	-	-

Table 8: Study related to incidence of pre-eclampsia after gastric banding versus obese women.

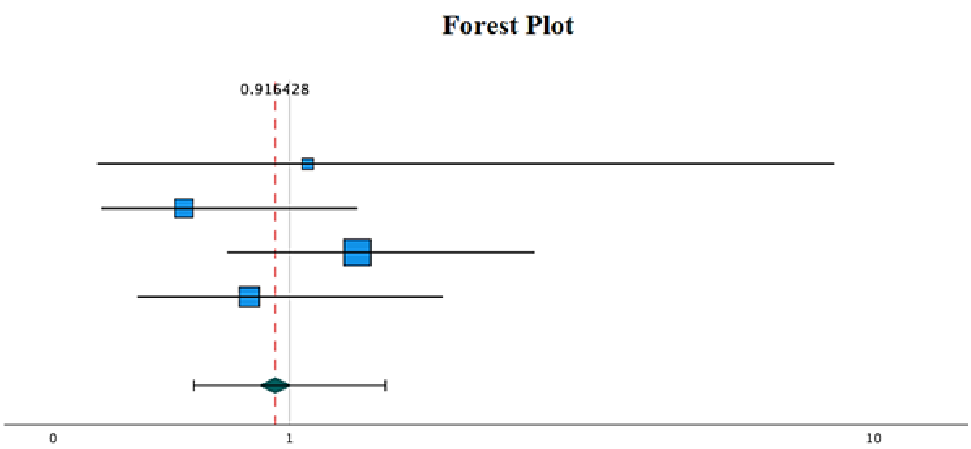

Figure 7: Forest plot of incidence of preterm delivery after gastric banding versus obese women. **Note:** ( ) Effect size of each study; ( ) Estimated overall effect size; ( ) No-effect value; ( ) Confidence interval of effect size; ( ) Overall effect size value; ( ) Estimated overall confidence interval; Model: Random-effects model; Heterogeneity: Tau-squared=0.06, H-squared=1.19, I-squared=0.16; Homogeneity: Q=2.82; df=3, p-value=0.42; Axis is shown using log scale.

ID	Study	OR	p-value	Weight	Weight (%)
1.00	Ducarme, et al. [10]	1.11	0.92	0.85	7.57
2.00	Dixon, et al. [9]	0.47	0.18	2.58	23.04
3.00	Lapolla, et al. [14]	1.43	0.36	4.68	41.87
4.00	Chevrot, et al. [11]	0.78	0.62	3.08	27.52
Overall		0.92	0.77	-	-

Table 9: Study related to incidence of preterm delivery after gastric banding versus obese women.

Outcome	Sleeve gastrectomy (6.9)	Gastric banding (6.1-15)
SGA	15.4% (3-19)	9.7% (1.4-9.4)
LGA	7.1% (3-9)	12.7% (4.5-21)
Gestational hypertension	4.1% (2-20)	8.7% (5-50)
Pre-eclampsia	0% (0)	6.4% (0-12)
Preterm delivery	8.7% (5-14)	11.2% (6-17.6)
Note: Data are presented as mean (min-max).		

Table 10: Summary of the incidence of study variables according to procedure type.

Discussion

Birth weight

Gastric banding: Dixon, et al. studied 79 women with pregnancies before and after gastric banding [9]. They found thatthe mean birth weight was almost the same, but the post-band pregnancies had less LGA. Ducarme, et al. found that the incidence of low birth weight was lower in the gastric banding group than in the control group (obese women without gastric banding) [10]. Lapolla, et al. conducted a cohort study of 83 pregnancies in 69 women after gastric banding, with a control group of pregnancies in the same women before gastric banding (27 pregnancies in the 69 women) and a second control group of 120 pregnancies in morbidly obese women [11-14]. Their results showed that when pregnancy outcomes were compared after gastric banding with unoperated obese pregnant women, there were lower rates of LGA babies. The rates of SGA babies did not differ between the three groups. Carelli, et al. conducted a study of pregnancy after gastric banding [15]. They looked at 121 pregnancies after gastric banding. They found that 8% had a low birth weight (<2500 g) but did not comment on SGA. The 8% was similar to the national statistics for low birth weight in the USA. They found that 7% had a high birth weight (>4000 g). However, they did not include the national statistics on high birth weight in the US. The systematic review by Vrebosch, et al. concluded that the incidence of low birth weight is lower in gastric banding pregnancies than in non-gastric banding pregnancies in obese women [19].

Sleeve gastrectomy: The cohort study by Coupaye, et al. found that the risk of SGA after sleeve gastrectomy was not lower than after Roux-en-Y gastric bypass [16]. In contrast, the majority of studies find that gastric bypass surgery is associated with a higher risk of SGA than sleeve gastrectomy.

Overall: The risk of macrosomia is increased with maternal obesity, so as expected. Guelinckx, et al. found a significant decrease in mean birth weight after surgical weight loss compared with pre-operative pregnancies [17]. On the other hand, they also found an increased risk of intrauterine growth restriction (IUGR) and SGA. Chevrot, et al. saw a twofold increase in SGA associated with bariatric surgery, mainly gastric bypass [11]. There was no increase in SGA in the pure restrictive group (primarily consisting of gastric banding). They suggest that only restrictive bariatric surgery should be performed in women of reproductive age. They also found that bariatric surgery was associated with a reduction in LGA. Cornthwaite, et al. found no difference in the risk of having an SGA infant between gastric banding and gastric sleeve [6]. Watanabe, et al. found that not all bariatric procedures may lead to lower fetal birth weight [12]. Neonates born to mothers with restrictive bariatric surgery did not have lower birth weights. They found a relation between anemia and decreased neonatal birth weight. They state that it is important to check the nutritional status of pregnant patients and correct when necessary. Sheiner, et al. conducted a retrospective cohort study including 449 deliveries after bariatric surgery [13]. They compared pregnancy outcomes between two main operations groups: Restrictive vs. malabsorptive procedures. They found no significant difference in low birth weight (<2.5 kg) or macrosomia (>4 kg). The review by Magdaleno, et al. found a decrease in the mean birth weight, less macrosomia, an increase in SGA, and an increase in IUGR after bariatric surgery [18]. These findings are probably due to metabolic changes with nutritional deficiencies following bariatric surgery.

The systematic review by Dalfra, et al. suggests that bariatric surgery could be partially successful in normalizing fetal growth [19,20]. The systematic review and meta-analysis by Galazis, et al. confirmed that the incidence of large neonates is reduced and that of small neonates is increased [21]. The metaanalysis found that the risk of large neonates is halved, and that of small neonates is increased by approximately 80%. A subgroup analysis showed that gastric banding did not affect the rate of small neonates. This suggests that restrictive rather than malabsorptive bariatric surgery should be preferred in young women planning to have children to minimize this complication. The systematic review and meta-analysis of Akhter, et al. showed that the odds of an SGA infant were more than doubled after bariatric surgery [22]. They found an increase mainly with malabsorptive surgery and no increase with restrictive surgery such as gastric banding and sleeve gastrectomy. The odds of an LGA infant were more than halved after bariatric surgery. A subgroup analysis showed that the malabsorptive group was associated with the biggest decrease in the odds of LGA. The clinical guideline by Ciangura, et al. confirms that the risk of an SGA infant is increased following bariatric surgery. They recommend monthly antenatal controls and ultrasound follow-up of fetal growth [23].

In our meta-analysis, we discovered that obese women who underwent gastric banding had a slightly lower incidence of SGA babies compared to the obese control group, but the difference was not statistically significant. We did not compare this to malabsorptive procedures like RYGB, but our findings suggest that malabsorptive surgery may increase the risk of having an SGA baby more than restrictive surgery. Additionally, our analysis showed that gastric banding may reduce the risk of having an LGA baby, but again, the difference was not statistically significant. Unfortunately, we could only analyze studies on gastric banding as no studies reported on sleeve gastrectomy. Therefore, we could not compare the incidence of SGA and LGA between gastric sleeves versus gastric banding.

Pre-eclampsia

Gastric banding vs. sleeve gastrectomy: Dixon, et al. compared obstetric complication rates in 79 women who underwent gastric banding for severe obesity before pregnancy (study patients), in 79 severely obese women who did not undergo gastric banding, and in the preceding pregnancy for 40 of the study patients [9]. They found that the incidence of gestational hypertension (10%) in patients after gastric banding was comparable with community levels (12%) and lower than in the obese cohort (38%). They found that the rates of preeclampsia were also reduced, 28% before gastric banding versus 5% after. In their retrospective case-control study, Ducarme, et al. found that the incidence of pre-eclampsia was lower in the gastric banding group than in the control group (obese women without gastric banding) [10]. Similarly, Lapolla, et al. found a significant reduction in pre-eclampsia in women after gastric banding compared with unoperated obese pregnant women [14]. Carelli, et al. found a 5% incidence of pre-eclampsia after gastric banding. However, they did not include US national statistics [15]. The systematic review by Vrebosch, et al. concluded that the incidence of pre-eclampsia in gastric banding pregnancies is lower than in non-gastric banding pregnancies in obese women but higher than in average-weight women without gastric banding [19]. The cohort study by Cornthwaite, et al. showed no difference between pre-eclampsia after gastric banding and gastric sleeve [6].

Overall: Similarly, Guelinckx, et al. found that in most studies, the risk of pre-eclampsia was reduced after bariatric surgery [17]. The systematic review by Dalfra, et al. of all types of bariatric surgery supports this statement, for all types of bariatric surgery [20]. The case-control study by Chevrot, et al. found no difference in pre-eclampsia after different types of bariatric surgery [11]. Similarly, Sheiner, et al. found no significant difference in pre-eclampsia after bariatric surgery [13]. The review by Magdaleno, et al. found a general trend toward lower rates of hypertensive disorders in pregnancies of patients who had undergone bariatric surgery [18]. The systematic review and meta-analysis by Galazis, et al. showed that the incidence of pre-eclampsia is reduced by bariatric surgery, and the meta-analysis confirmed that there is a 50% reduction in risk [21].

Our meta-analysis confirms that gastric banding reduces the incidence of hypertensive disorders in pregnancy when compared to unoperated obese women, in line with previous studies. While we couldn't differentiate between early and late pre-eclampsia, we could differentiate between gestational hypertension and pre-eclampsia. Unfortunately, we were unable to compare the incidence of gestational hypertension and pre-eclampsia between gastric banding and gastric sleeve procedures.

Preterm delivery

Gastric banding vs. sleeve gastrectomy: Cornthwaite, et al. showed that the risk of preterm birth was comparable between women with sleeve and bypass/banding [6]. However, they found that infants of mothers with gastric banding (13.1%) were more likely to be born preterm than bypass (8.3%). Dixon, et al. found no difference in preterm birth before and after gastric banding [9]. On the contrary, Carelli, et al. found that 6% had a preterm delivery after gastric banding [15]. This is lower than the national statistics for preterm birth in the USA (12.7%). The systematic review by Vrebosch, et al. concluded that the rate of preterm birth was higher in the gastric banding group than in the average-weight group [19]. The systematic review by Dalfra, et al. found no increase in preterm birth after bariatric surgery in general, but there were more preterm births after gastric bypass than gastric banding [20]. However, the systematic review and meta-analysis by Galazis, et al. contradict these findings, finding that bariatric surgery is associated with a 28% increase in preterm birth [21]. In a subgroup analysis, they found no difference in the rate of preterm birth after gastric banding.

Overall: Guelinckx, et al. described that the prematurity rate does not appear to be significantly changed in pregnancies after bariatric surgery, compared with pregnancies prior to surgery [17]. Similarly, Chevrot, et al. and Sheiner, et al. did not find a significant difference in preterm delivery after different types of bariatric surgery [11,13]. The systematic review and meta-analysis by Akhter, et al. reported that the overall odds of preterm birth were significantly increased after bariatric surgery compared to women without prior bariatric surgery [22]. The clinical guideline by Ciangura, et al. confirms the risk of prematurity with pregnancies after bariatric surgery [23].

Our study's findings differ from previous research that indicated a higher likelihood of preterm birth following bariatric surgery. Our meta-analysis suggests that the risk of premature delivery is actually lower after gastric banding, though the results did not reach statistical significance. This conclusion was based on a comparison with obese women who did not undergo surgery. Again, we could not compare the rates of preterm delivery for gastric banding and sleeve gastrectomy.

Conclusion

It is important to educate women about the potential risks during pregnancy after bariatric surgery. While the risk of having an LGA newborn seems to be reduced due to a decrease in maternal BMI, there is an increased risk of having an SGA newborn. The risks vary between different types of bariatric surgery. Restrictive bariatric surgery appears to have a lower risk of having SGA newborns compared to malabsorptive surgery, while the risk of LGA newborns remains the same. We could not test for a difference between sleeve gastrectomy and gastric banding. This finding suggests that sleeve gastrectomy may be a better option for women of reproductive age, as gastric banding is not commonly used anymore. However, there is insufficient evidence on the effects of sleeve gastrectomy on pregnancy.

The data on preterm delivery after bariatric surgeries vary widely: Different studies report different results on preterm birth after gastric banding; some say it increases the risk, and others say there is no difference. Even one trial says there is a reduced risk of preterm birth after gastric banding. In general, there seems to be an increased risk of preterm birth after bariatric surgery. There doesn't seem to be any difference in the risk of preterm birth between gastric banding and sleeve gastrectomy.

Research has focused on the prevalence of positive and adverse pregnancy outcomes after bariatric surgery, especially after malabsorptive procedures such as RYGB, and the difference between malabsorptive and restrictive procedures. It appears that there are some differences between the two groups and some studies suggest that restrictive surgery is better for women of childbearing age. It should be noted that most trials only included gastric banding in the restrictive group. There is a lack of evidence on the effects of gastric sleeve on perinatal outcomes. Therefore, it is not possible to compare the perinatal outcomes of gastric banding and gastric sleeve. We were only able to do a metaanalysis of a small proportion of the trials of gastric banding that had obese women as controls. There were no trials that compared sleeve gastrectomy with obese women, or even sleeve gastrectomy with gastric banding. More research is needed before conclusions can be drawn. As gastric banding has largely been abandoned in Belgium, it might be useful to do more research in this area.

References

1. Louwagie P, Neyt M, Dossche D, Camberlin C, Geuzendam BT, et al. (2019) Bariatric surgery: An HTA report on the efficacy, safety and cost-effectiveness. KCE Report 316.
2. Health at a glance 2017. (2018). OECD Indicators. 1-220.
3. Heyden JV, Nguyen D, Renard F, Scohy A, Demarest S, et al. (2018) Belgian health research 2018. Belgian Health Examination Survey (BELHES). 1-136.
4. Meeus P, Dalcq V, Beauport D, Declercq K, Hoekx L, et al. (2022) Variations in medical practices.
5. Shawe J, Ceulemans D, Akhter Z, Neff K, Hart K, et al. (2019) Pregnancy after bariatric surgery: Consensus recommendations for periconception, antenatal and postnatal care. Obes Rev 20: 1507-1522.
6. Cornthwaite K, Prajapati C, Lenguerrand E, Knight M, Blencowe N, et al. (2021) Pregnancy outcomes following different types of bariatric surgery: A national cohort study. Eur J Obstet Gynecol Reprod Biol 260: 10-17.
7. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, et al. (2021) The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ 88: 105906.
8. Wells G, Shea B, O'Connell D, Peterson J, Welch V, et al. (2013) The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. 1-4.
9. Dixon JB, Dixon ME, O'Brien PE (2005) Birth Outcomes in obese women after laparoscopic adjustable gastric banding. Obstet Gynecol 106: 965-972.
10. Ducarme G, Revaux A, Rodrigues A, Aissaoui F, Pharisien I, et al. (2007) Obstetric outcome following laparoscopic adjustable gastric banding. Int J Gynaecol Obstet 98: 244-247.
11. Chevrot A, Kayem G, Coupaye M, Lesage N, Msika S, et al. (2016) Impact of bariatric surgery on fetal growth restriction: Experience of a perinatal and bariatric surgery center. Am J Obstet Gynecol 214: 655.e1-655.e7.
12. Watanabe A, Seki Y, Haruta H, Kikkawa E, Kasama K (2019) Maternal impacts and perinatal outcomes after three types of bariatric surgery at a single institution. Arch Gynecol Obstet 300: 145-152.
13. Sheiner E, Balaban E, Dreiher J, Levi I, Levy A (2009) Pregnancy outcome in patients following different types of bariatric surgeries. Obes Surg 19: 1286-1292.
14. Lapolla A, Marangon M, Dalfrà MG, Segato G, De Luca M, et al. (2010) Pregnancy outcome in morbidly obese women before and after laparoscopic gastric banding. Obes Surg 20: 1251-1257.
15. Carelli AM, Ren CJ, Youn HA, Friedman EB, Finger AE, et al. (2011) Impact of laparoscopic adjustable gastric banding on pregnancy, maternal weight, and neonatal health. Obes Surg 21: 1552-1558.
16. Coupaye M, Legardeur H, Sami O, Calabrese D, Mandelbrot L, et al. (2018) Impact of Roux-en-Y gastric bypass and sleeve gastrectomy on fetal growth and relationship with maternal nutritional status. Surg Obes Relat Dis 14: 1488-1494.
17. Guelinckx I, Devlieger R, Vansant G (2008) Reproductive outcome after bariatric surgery: A critical review. Hum Reprod Update 15: 189-201.
18. Magdaleno R, Pereira BG, Chaim EA, Turato ER (2012) Pregnancy after bariatric surgery: A current view of maternal, obstetrical and perinatal challenges. Arch Gynecol Obstet 285: 559-566.
19. Vrebosch L, Bel S, Vansant G, Guelinckx I, Devlieger R (2012) Maternal and neonatal outcome after laparoscopic adjustable gastric banding: A systematic review. Obes Surg 22: 1568-1579.
20. Dalfrà MG, Busetto L, Chilelli NC, Lapolla A (2012) Pregnancy and foetal outcome after bariatric surgery: A review of recent studies. J Matern Fetal Neonatal Med 25: 1537-1543.
21. Galazis N, Docheva N, Simillis C, Nicolaides KH. (2014) Maternal and neonatal outcomes in women undergoing bariatric surgery: A systematic review and meta-analysis. Eur J Obstet Gynecol Reprod Biol 181: 45-53.
22. Akhter Z, Rankin J, Ceulemans D, Ngongalah L, Ackroyd R, et al. (2019) Pregnancy after bariatric surgery and adverse perinatal outcomes: A systematic review and meta-analysis. PLoS Med 16: e1002866.
23. Ciangura C, Coupaye M, Deruelle P, Gascoin G, Calabrese D, et al. (2019) Clinical practice guidelines for childbearing female candidates for bariatric surgery, pregnancy, and post-partum management after bariatric surgery. Obes Surg 29: 3722-3723.