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Pregnancy following gastric bypass surgery: what is the expected course and outcome?

Nikhil Sapre, Karen Munting, Archana Pandita, Richard Stubbs

Abstract

Aim To examine the course of pregnancy, labour, and the neonatal period in a group of women who have become pregnant following gastric bypass surgery for severe obesity.

Methods Women who had experienced pregnancy following gastric bypass surgery were identified by an initial questionnaire. A second questionnaire was sent to those identified by the first questionnaire, who were willing to provide details concerning such pregnancies.

Results Seventeen women experienced a total of 24 pregnancies and 25 live births. Five had experienced difficulties with conception or pregnancy prior to surgery. The average maternal weight gain was 6.13 kg. No major problems with fetal growth were observed. Babies were delivered at a mean gestational age of 37.5 weeks and with a mean birth weight of 3038 g. Six women reported a complication during pregnancy (25%) and five a complication in labour (20%). Two babies born to the same mother had congenital abnormalities attributable to a rare genetic disorder.

Conclusion The course of pregnancy and labour appears normalised for severely obese women following gastric bypass surgery. The weight loss and marked reduction in food intake following gastric bypass surgery does not lead to growth or development problems for offspring. Careful monitoring of expectant mothers who have undergone gastric bypass surgery is nevertheless to be recommended.

The prevalence of obesity in New Zealand is increasing with 1 in every 5 adults being obese.[1] It is well documented that pregnancy in obese women is associated with an increased risk of many adverse events and outcomes. These include such things as pre-eclampsia, the need for induction of labour, caesarian section, post-partum haemorrhage, and large for gestational age (LGA) deliveries.[2] In addition, severely obese women are at increased risk of gestational diabetes and their babies of congenital birth defects, neonatal hypoglycaemia, jaundice, and the need for admission to neonatal intensive care.[3]

Severely obese mothers are at increased risk of thromboembolism, anaesthetic complications, and wound infections following caesarean section.[4] Similar adverse neonatal and perinatal outcomes have been reported for overweight adolescent women.[5]

Bariatric surgery has emerged in the last 10–15 years as an effective and reliable solution to severe obesity[6] and more and more severely obese individuals are choosing this option for managing their problem. Although a number of previous

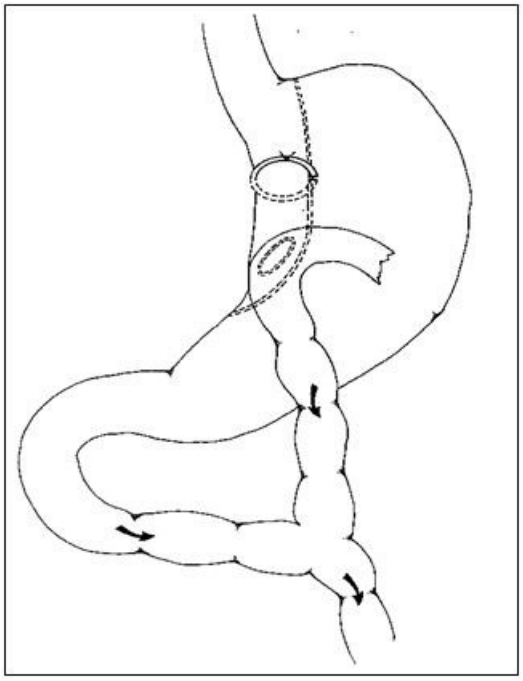
reports have addressed the course and outcome of pregnancy in women who have undergone bariatric surgery[7–12] such information remains poorly disseminated.

At a time when most health professionals have little personal knowledge or experience of bariatric surgery, many remain uncertain about the expected course of pregnancy and delivery for mothers who have had bariatric surgery. This report documents the outcomes of 24 pregnancies in 17 women following gastric bypass surgery for severe obesity.

Methods

This study was undertaken on women who had undergone gastric bypass surgery at Wakefield Hospital, Wellington. All surgeries were performed by the senior author (RSS) who has performed over 1100 gastric bypass operations since 1986. See Figure 1.

Figure 1. A schematic representation of the gastric bypass operation



A full description of the operation and its outcomes is available elsewhere.[13] In brief, the stomach is divided into two component parts. A small 5-10 ml gastric pouch extending from the oesophago-gastric junction down the lesser curve of the stomach and a large distal component of the stomach, which together with the duodenum and initial 50–70 cm of jejunum is excluded from the food stream.

A 70 cm Roux loop of jejunum is created and joined to the small gastric pouch, which means ingested food enters directly into the jejunum. A silastic rubber ring of 6.5 cm circumference (approximately 19mm diameter) is placed around the small gastric pouch above the anastomosis in such a way as to ensure the size of the outlet of the pouch remains fixed throughout life.

Food intake is severely restricted with average daily caloric intakes being reduced to less than 1000kcal for life. Weight loss of around 65–75% of excess weight is to be expected over a 12-18 month period with much of this occurring in the first 6 months.[14]

Vitamin intake is reduced commensurate with food intake, and absorption of fat soluble vitamins may be particularly affected by low fat intake. Absorption of vitamin B12 is affected by the bypass of the body of the stomach and folic acid and iron absorption by the bypass of the duodenum. All those who

have undergone gastric bypass are encouraged to take a multivitamin tablet daily for life, and those who develop deficiencies of vitamin B12, folic acid or iron, are placed on appropriate supplements for life in the case of the former two, and as required in the case of iron.

A variety of blood tests are performed at intervals throughout the first 2 years following gastric bypass to detect these deficiencies, and are then recommended at annual intervals throughout life.

The subjects of this study were identified by sending an initial questionnaire to all women of childbearing age (20–40 years) who appeared on the prospective Wakefield Clinic obesity surgery database (1100 patients), who had undergone surgery since 1991, seeking those who had become pregnant at any time following their gastric bypass operation. Those who had experienced a pregnancy, whether successful or not, were asked to participate in the present study, by completing a further questionnaire seeking details of the course of the pregnancy, labour and subsequent outcome.

Additional information was obtained from some participants by phone call, where responses were either incomplete or unclear. As this was simply an audit of pregnancy in a single doctor's practice, Ethics Committee approval was not considered necessary.

Obstetric care—The obstetric care was provided in various facilities throughout New Zealand. The Wakefield Clinic was not actively involved in the management of any pregnancy, although in some cases was contacted by attending doctors/midwives for information and/or advice regarding vitamin and mineral supplementation during the pregnancy.

Results

The initial questionnaire was mailed to 165 women who had undergone gastric bypass between May 1991 and December 2005. From this group 19 were identified as having become pregnant at a time subsequent to the gastric bypass surgery. Seventeen agreed to participate in the study, but it is known there were no major problems encountered by the other two, who preferred not to provide details concerning their pregnancy.

Of the 17 women, 9 had experienced one pregnancy and delivery each, 7 had each experienced two pregnancies and deliveries since their surgery (14 pregnancies) and 1 had twins which were counted as one pregnancy and two deliveries. The average age at the time of delivery was 30.9 years (range 27–42). Twelve of the women had experienced 16 pregnancies prior to having gastric bypass, of which 13 resulted in live births. Two women had miscarried prior to their gastric bypass on one and two occasions respectively.

The issues related to the pregnancy, labour, and delivery are summarised in Tables 1–3 below.

Table 1. Issues related to pregnancy itself

Changes in eating pattern	
increase	8
no change	9
decrease	6 (3 morning sickness)
Weight gain	mean 6.13 kg (range, loss 25 kg – gain 26 kg)
Miscarriages	0 (1 threatened pre-term labour at 22/40)
Pre-eclampsia	1
Gestational diabetes	0
Premature rupture of membranes	1 (30 weeks)

Table 2. Issues related to labour and delivery

Gestational age at birth	mean 37.5 weeks (range 30–40 weeks)
Duration of labour	mean 7.2 hr (range 35 min–26 hr)
Caesarian section	
elective	2
emergency	6
Vaginal delivery	
normal	14
assisted	2

Table 3. Issues related to the babies and the outcome of pregnancy

Live births	25 (1 set of twins)
males	12
females	13
Gestational age at birth	mean 37.5 weeks (range 30–40 weeks)
Birth weight	mean 3038 g (range 1720–4240 g)
Mean APGAR scores	
0 min	7.75
5 min	8.54
10 min	9.38
Breast fed	18 (median time 4.5 mo, range 3 d–12 mo)

Three of the 17 women had a history of infertility prior to surgery, two having polycystic ovary disease (PCOD) alone and one having PCOD and endometriosis. All three had previously received medication to assist fertility without a positive outcome. Each of the two women, who gave a history of miscarriage and no viable pregnancy prior to surgery, conceived within 12 months following surgery and achieved live births.

All 17 women received nutritional supplements in the course of their pregnancies in the form of intramuscular vitamin B12 (54%), daily folic acid tablets (92%) or iron supplements (92%). In 21 pregnancies, supplements were given for a documented deficiency, detected prior to or during the pregnancy, but simply as a precaution against deficiency in the remaining three pregnancies.

Delivery occurred at a mean time of 42.5 months following gastric bypass (range 12-147 months). Four women conceived within 12 months of the bypass, at a time when weight loss was still occurring. Only two of these reported a slowing of the rate of weight loss. Six mothers reported a complication in pregnancy, four of whom also had a complication in labour.

One, who reported low blood pressure and low blood sugars in pregnancy, was induced at 38.5 weeks which resulted in an emergency caesarean section being performed for fetal distress. She delivered a boy weighing 4240g, with APGAR scores of 2, 8, and 10 at birth, 5 min and 10 min respectively. Although the baby needed bag masking for 2 minutes following delivery there were no subsequent concerns with growth and development. The second mother, who suffered chronic pelvic pain throughout pregnancy, developed signs of fetal distress after a labour of 12 hours at 35 weeks and went on to have an assisted vaginal delivery. Although the

baby's weight and APGAR scores were satisfactory he spent 8 days in the neonatal unit as per that hospital's policy for premature babies. There were no subsequent growth or developmental concerns.

A third mother experienced high blood pressure during pregnancy and after a prolonged 24 hr labour at 38 weeks she failed to dilate and developed signs of fetal distress. She underwent an emergency caesarean section and delivered a healthy 2400 g baby girl. Another mother had threatened preterm labour at 22 weeks and spent five nights in hospital. As a consequence of disrupting her symphysis pubis she was in a wheelchair from 28–36 weeks. She went on to have a normal delivery at 38 weeks and produced a healthy 3210 g baby boy. Two other women experienced complications during pregnancy, (one low blood pressure, one incisional hernia) but delivered normal, healthy babies following normal labour.

In addition to the already mentioned four complications in labour, a further five women (total nine) experienced complications during labour. One woman had premature rupture of membranes at 30 weeks and, following steroid therapy, underwent caesarean section. She delivered a 1600 g son, who spent 5 weeks in the neonatal unit requiring ventilatory and feeding support. He exhibited catch up by the end of his second year and there have been no subsequent concerns. Another, whose baby was thought to have intrauterine growth retardation, was induced at 39 weeks and had an assisted vaginal delivery. A healthy baby of normal weight (3035 g) was the result.

The third mother, who gave birth to twins, had an antenatal haemorrhage at 36 weeks which led to an emergency caesarian section. Although one twin spent 3 weeks in the neonatal unit as a result of poor feeding, both babies ultimately had excellent outcomes. In two other instances, babies developed fetal distress necessitating emergency caesarean section in one. Both pregnancies resulted in the delivery of normal, healthy babies.

Congenital abnormalities occurred in two babies born to the same mother, in two consecutive pregnancies. In the first, there was mild spina bifida, caudal regression, heterotaxy, polysplenia, and she now has a colostomy. The second had caudal regression with bladder and bowel dysfunction recognised after 20 weeks of life. It is now known that both have an extremely rare autosomal recessive genetic disorder—*caudal regression with polysplenia and heterotaxy syndrome*. There was no evidence of folic acid deficiency at any stage in either pregnancy, and the mother was receiving folic acid supplements throughout.

In both instances the pregnancy and labour proceeded normally. The birth weights of the daughters were 1720 an 2795 respectively and both had normal APGAR scores at birth. The first baby spent five weeks in the neonatal unit requiring assisted ventilation. Both have displayed growth retardation with delayed milestones as a result of their genetic disorder.

Discussion

There has been growing acceptance over the last 10 years, that bariatric surgery is not only a highly effective tool for managing severe obesity, but is currently the only reliably effective tool for doing so. In spite of the financial and resource implications

for health services, the numbers of operations performed has increased exponentially in the US, Australia, and throughout Europe. New Zealand has been slower than many other countries in recognising the need for and desirability of offering such surgery to severely obese individuals, but that is changing, as the Public Hospital sector begins to face the bourgeoning problems and cost of severe obesity.

There are currently estimated to be in excess of 800 cases being performed per year in New Zealand, a number which is likely to grow steadily over the next few years. Around eighty percent of procedures are currently being undertaken in women, and at least half of these, in women of child bearing age.[14] Pregnancy in those who have undergone surgery will therefore be encountered with increasing frequency. It is appropriate that there be some dissemination of knowledge in respect of the course and outcome of pregnancy after bariatric surgery.

It is known that severe obesity is a complicating feature for pregnancy with an increased incidence of problems related to conception, course of pregnancy, labour and in the neonatal period.[2-4] While gastric bypass surgery is very reliable at bringing about major weight loss in the severely obese,[6,13,14] it does so in part by bringing about a major reduction in food intake, and carries with it a prospect of micronutrient and vitamin deficiency. It is therefore not surprising that concerns are raised from time to time, in the minds of those managing pregnancy in women following gastric bypass surgery, in respect of the course and outcome of pregnancy in such women.

It is known that women with high BMI put on less weight during pregnancy than women of lower BMI. The mean weight gain of 6.13 kg seen in our patients is a little less than the average weight gain for an obstetric population. The Institute of Medicine, Washington DC, recommends upwards of 6.8 kg weight gain for women of BMI>29.[15] In a study of pregnancy outcomes following laparoscopic adjustable gastric banding (LAGB) Ducarme et al reported an average weight gain of 5.5 kg in those who had undergone LAGB compared to 7.1 kg in a control group of obese women who had not undergone surgery.

In spite of this lower weight gain, they reported a significantly lower incidence of pre-eclampsia, gestational diabetes, low birth weight, fetal macrosomia and caesarian sections in the LAGB group compared to the controls and neonatal outcomes were not different.[7]

Our study also seems to indicate that bariatric surgery may reduce the risk of the adverse neonatal outcomes that are usually associated with obese populations such as macrosomia, hypoglycaemia, jaundice and birth defects – an average birth weight of 3038 grams and APGAR scores at 0, 5, and 10 minutes of 7.75, 8.54, and 9.38 certainly reflect excellent outcomes compared to those usually associated with pregnancies in unoperated severely obese women. There was only one baby in our group with a birth weight over 4000 g and the only instance of low birth weight was associated with premature birth at 30 weeks.

The findings of this and other reports are reassuring for those who wonder if a degree of intrauterine growth retardation or restriction may also occur in this context. However, it should be noted that in making this statement we have relied on birth weights rather than a formal monitoring of Gestation Related Optimal Weights as suggested by the GROW programme.

Apart from issues for the two babies born to the same mother, with congenital abnormalities related to a very rare, autosomal recessive syndrome, there are no ongoing concerns regarding growth and development in any of the babies in our series.

The incidence of hypertension in pregnancy in the normal non-obese population is reported to be 12–25% and that of pre-eclampsia 5–7%.[16] In severely obese women, the incidence figures are reported in various case series to be three to seven times higher.[2–4] The incidence of gestational diabetes in pregnancies in normal weight women is 1–2%[17] but in an Australian study of pregnancy in obese women the incidence was seven times higher.[3]

Given that only one mother in our series developed hypertension and none developed gestational diabetes, it seems reasonable to conclude that these complications are less likely to occur than in pregnancies of obese women who have not undergone bariatric surgery. This statement is supported by other reports of pregnancy outcomes following bariatric surgery.[7–12]

It is perhaps important to note that oral glucose tolerance testing will not usually be possible following gastric bypass because of intolerance to 75 g of glucose by mouth. Such an intake will generally lead to severe dumping and vomiting, which will affect the test result. Detection of gestational diabetes should therefore rely on the measurement of fasting glucose and perhaps 2-hour post-prandial glucose.

Six deliveries (24%) were by emergency caesarian sections. This compares with reported figures of 10–15% in pregnancies in the non-obese population[16] and reported rates 2.5–3 times higher in an obese obstetric population.[2,3] In two of the six instances caesarian section was done for ante-partum haemorrhage in a known twin pregnancy. It is well known that this complication is significantly more common in twin pregnancies. Another was for a premature delivery at 30 weeks and the remaining three (12%) for fetal distress at term. Perhaps our caesarian section rate is then best considered similar to or less than that for obese women who have not undergone bariatric surgery.

The caesarean section rate is also affected by parity, and previous caesarean section, when severe obesity existed, and also by practice norms. Thus the rates reported for bariatric surgery patients in North America are not surprisingly rather higher.[9,11]

It is now known that gastric bypass surgery improves fertility by reducing insulin resistance. Our study supports this finding—3 women with diagnosed infertility who had been unable to conceive despite medical treatment prior to surgery, did conceive following surgery. Two others, each of whom had experienced one or more miscarriages and no viable pregnancies prior to surgery, conceived within one year of surgery, suggesting a degree of subfertility prior to gastric bypass surgery.

It has often been thought and advised that following bariatric surgery, women should not conceive within the first year when rapid weight loss is taking place. In our study group, four women did conceive within this timeframe but in no instance was there any basis for concern in relation to the baby's growth or development. Indeed, in two of these women, a slowing of weight loss was noted during the pregnancy.

Another report of pregnancy in 26 women following laparoscopic gastric bypass similarly found no greater complication rate in four pregnancies where conception occurred within the first 12 months following surgery when compared with those that occurred beyond the first 12 months.[9]

Small bowel obstruction requiring surgery was not seen in this series of patients who all underwent *open* gastric bypass surgery, but has been reported particularly in pregnancies following *laparoscopic* gastric bypass.[18,19] Open surgery is generally required to address the problem, with a significant prospect of need for bowel resection and even maternal and infant mortality.[18] The frequency of this complication remains uncertain but given the high numbers of procedures in women of child bearing age that may be expected to be carried out in the future, this is of some concern. Knowledge of the possibility and its early recognition is key to avoiding significant risk to both mother and baby.

Diagnosis is difficult and problematic because of the reluctance to undertake abdominal X-rays during pregnancy and because of confusion with abdominal signs and symptoms in the pregnant state. The complication is caused by internal herniation of small bowel, through mesenteric defects created at the time of the bypass, and may occur even when these have been closed. This complication is less often seen after open gastric bypass because mesenteric defects are more easily and reliably closed at open surgery and because adhesion formation may also reduce the likelihood of internal hernia occurrence.

This study, although involving relatively small numbers, when considered alongside other published reports indicates that pregnancy following bariatric surgery, far from being of particular concern, is likely to proceed more normally that pregnancy in severely obese women. It seems that bariatric surgery reduces the rate of comorbidities conferred by obesity in pregnancy such as the gestational diabetes, hypertension, spontaneous abortion, pre-eclampsia and macrosomia.

Even when mothers conceive within the first year following surgery, there do not appear to be any significant nutritional issues for their babies. Given the known reduced intake and absorption of a number of vitamins that occurs particularly after gastric bypass surgery, it is very important that mothers be taking folic acid and iron supplements throughout pregnancy and that their vitamin B12 levels are watched and supported if necessary.

It is also sensible that a regular multivitamin tablet be taken. The principal and only reported downside for pregnancy following gastric bypass, particularly *laparoscopic* gastric bypass, is the possibility of small bowel obstruction occurring in pregnancy from an internal hernia. Such an occurrence will usually require laparotomy, and is associated with serious risk to both mother and baby. Prompt and careful fluid and surgical management, is necessary for good outcomes.

Despite the reassuring findings of this study it remains desirable that expectant mothers who have undergone surgery for severe obesity should be kept under careful and regular supervision throughout pregnancy.

Competing interests: None known.

Author information: Nikhil Sapre, House Surgeon[2,3]; Karen Munting, Practice Nurse[1]; Archana Pandita, House Surgeon[2]; Richard Stubbs, Surgeon and Professor[1,3]

1. The Wakefield Clinic, Wellington
2. Waikato Hospital, Hamilton
3. Wellington School of Medicine and Health Sciences, University of Otago, Wellington

Correspondence: Professor Richard Stubbs, Wakefield Gastroenterology Centre**,** Private Bag 7909**,** Wellington**,** New Zealand. Email: rsstubbs@wakefieldclinic.co.nz

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